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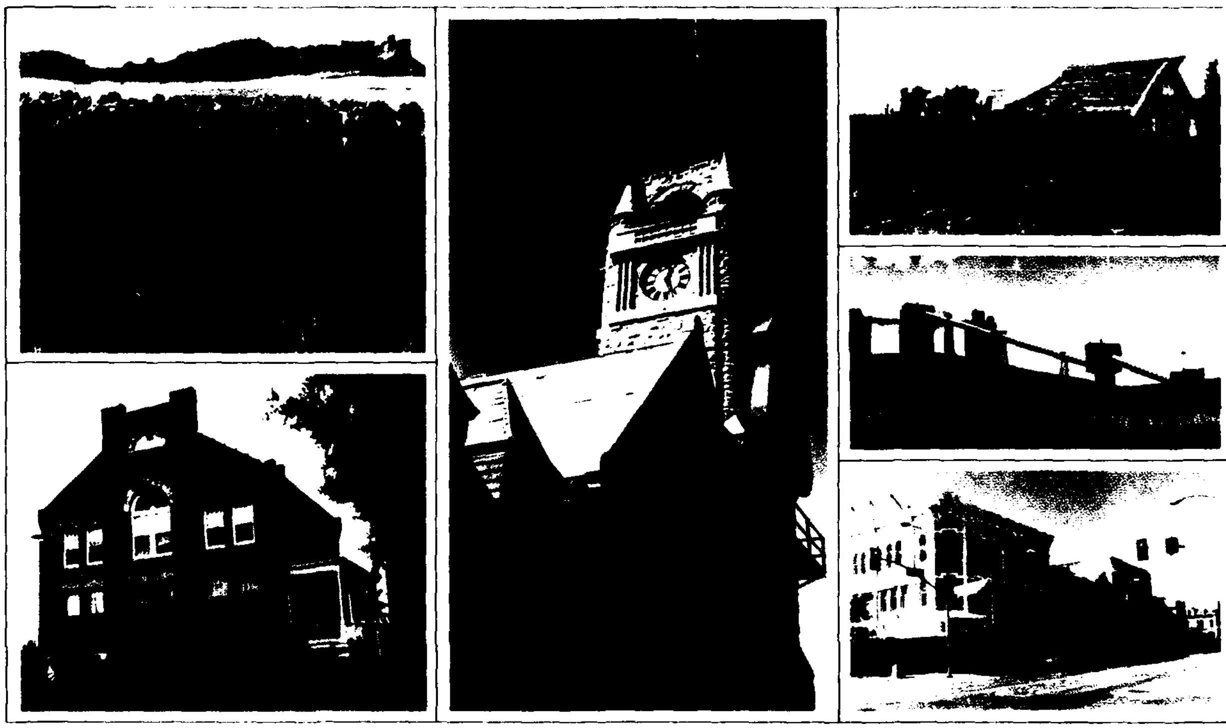
FINAL ENVIRONMENTAL PLANNING TECHNICAL REPORT



NOISE

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FINAL ENVIRONMENTAL PLANNING
TECHNICAL REPORT

NOISE

January 1984

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PREFACE

The President has directed that the Air Force deploy the Peacekeeper missile system at a location near F.E. Warren Air Force Base (hereafter F.E. Warren AFB), close to Cheyenne, Wyoming. The Peacekeeper system (formerly known as the M-X system) is an advanced, land-based intercontinental ballistic missile. The plan calls for the replacement of 100 existing Minuteman III missiles with 100 Peacekeeper missiles. Existing missile silos will be used, and there will be very little structural modification needed. Missile replacement will occur within the two squadrons (of 50 missiles each) located nearest F.E. Warren AFB, the 319th and 400th Strategic Missile Squadrons. Peacekeeper deployment will occur between 1984 and 1989.

An environmental impact statement (EIS) was prepared for the Proposed Action as outlined above. Information contained in the EIS is based upon environmental information and analysis developed and reported in a series of 13 final environmental planning technical reports (EPTRs). This volume is one of those reports. The 13 resource areas are:

- Socioeconomics (employment demand, housing, public finance, construction resources, and social well-being);
- Public Services and Facilities;
- Utilities;
- Energy Resources;
- Transportation;
- Land Use (land use, recreation, and visual resources);
- Cultural and Paleontological Resources;
- Water Resources;
- Biological Resources;
- Geologic Resources;
- Noise;
- Air Quality;
- Jurisdictional.

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1.0

INTRODUCTION

1.0 INTRODUCTION

This final environmental planning technical report (EPTR) is a companion document to the noise section of the final environmental impact statement (FEIS) for the Peacekeeper in Minuteman Silos project. It provides data, methodologies, and analyses which supplement and extend those presented in the FEIS.

This final EPTR consists of six major sections and appendices. Section 1.0 provides an overview of the Peacekeeper in Minuteman Silos project and a description of the noise resource and its elements.

Section 2.0 presents a detailed description of the environment potentially affected by the project. It includes a capsule description of the environmental setting (Section 2.1) and project requirements (Section 2.2). Section 2.3 defines the Region of Influence and Area of Concentrated Study for the resource. Section 2.4 (Derivation of Data Base) follows with a discussion of the literature sources, group and agency contacts, and primary data which provide the data base for the report. Section 2.5 describes analytic methods used to determine existing environmental conditions in the Region of Influence. Detailed analyses of the existing environment, broken down by constituent elements of the resource, follow in Section 2.6.

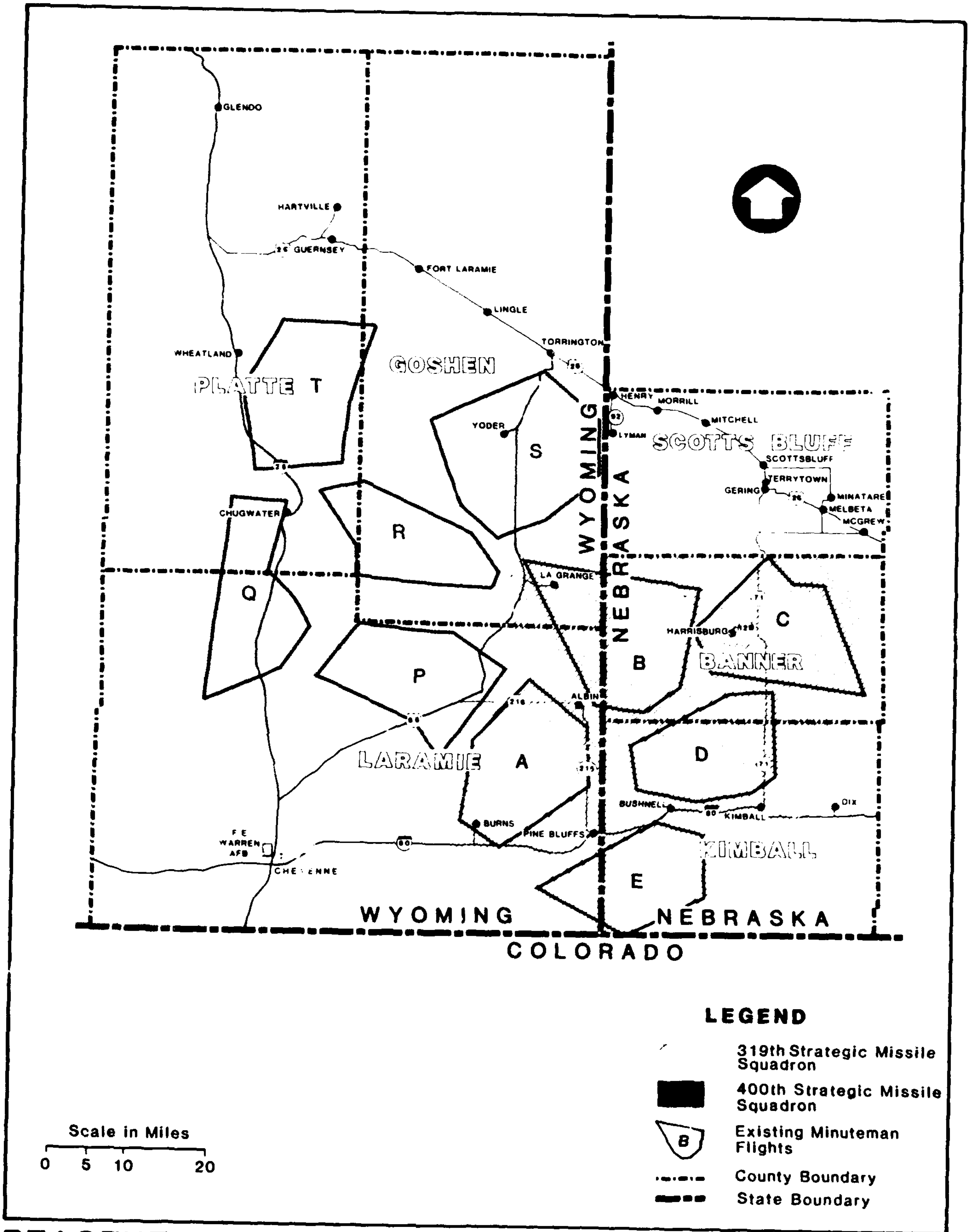
Section 3.0 describes environmental consequences of the Proposed Action and its project element alternatives, the No Action Alternative, mitigation measures, and unavoidable impacts. It contains detailed definitions of each potential level of impact (negligible, low, moderate, and high) for both short-term and long-term impacts. Beneficial effects are also discussed. Definitions of significance are also included. Methods used for analyzing future baseline and project impacts are described, as are assumptions and assumed mitigations. Additional mitigation measures to reduce project impacts are also described.

Sections 4.0 (Glossary), 5.0 (References), 6.0 (List of Preparers), Appendix A (Ambient Noise Monitoring Program), Appendix B (Noise Model Descriptions), Appendix C (Noise Level Contour Graphics), and Appendix D (Noise Assumptions) conclude the EPTR.

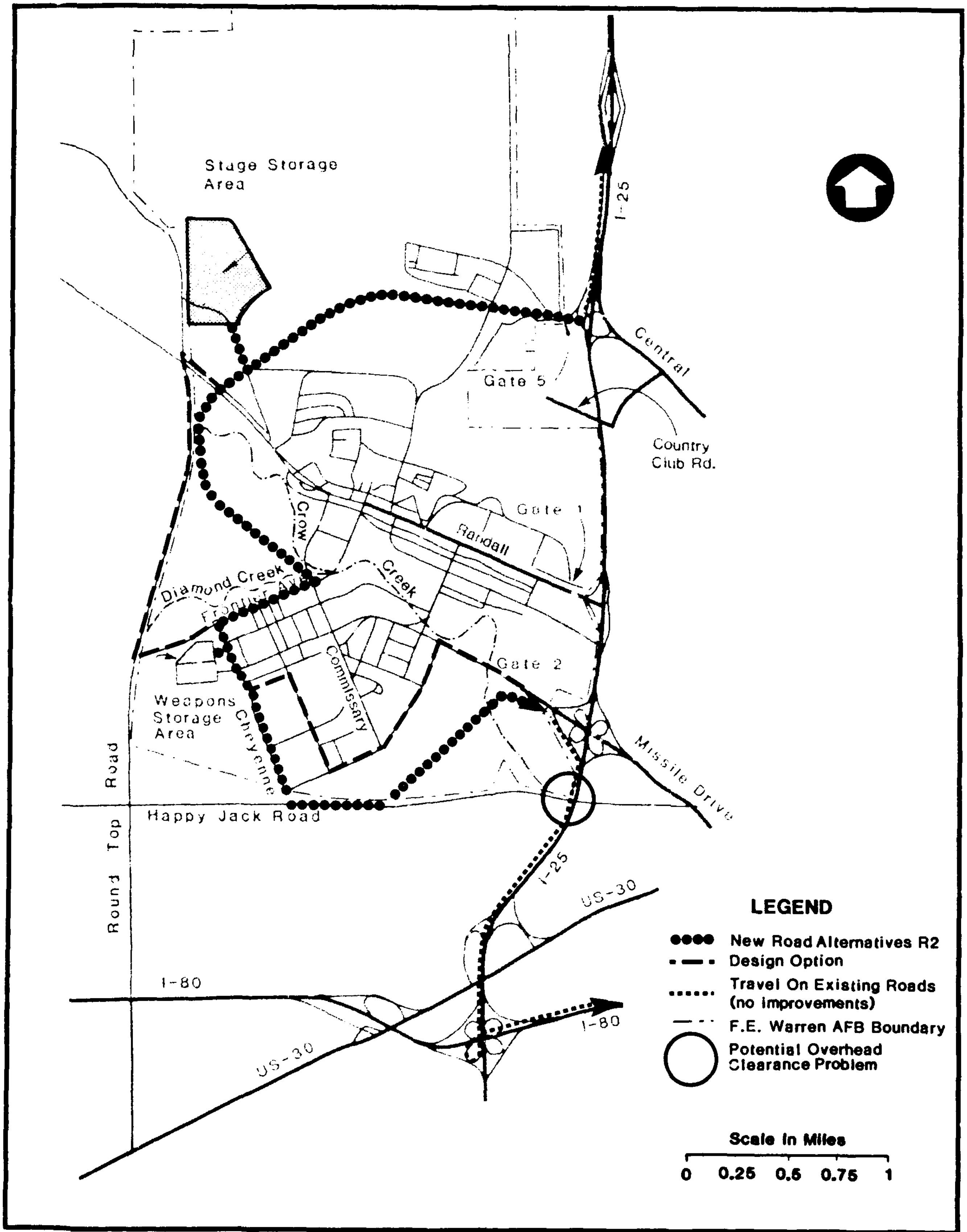
1.1 Peacekeeper in Minuteman Silos

The Peacekeeper system, which the Air Force plans to deploy within the 90th Strategic Missile Wing at F.E. Warren Air Force Base (AFB), Wyoming, is an advanced land-based intercontinental ballistic missile system designed to improve the nation's strategic deterrent force. Deployment of the Peacekeeper calls for replacement of 100 existing Minuteman III missiles with 100 Peacekeeper missiles. Missile replacement will occur in the 319th and 400th Strategic Missile Squadrons, located nearest F.E. Warren AFB (Figure 1.1-1). The Deployment Area covers parts of southeastern Wyoming and the southwestern Nebraska Panhandle.

Construction at F.E. Warren AFB will occur between 1984 and 1986. Fourteen new buildings will be constructed, and modifications or additions will be made to 11 existing buildings. Approximately 400,000 square feet of floor space will be built or modified. A new road configuration, to be selected from

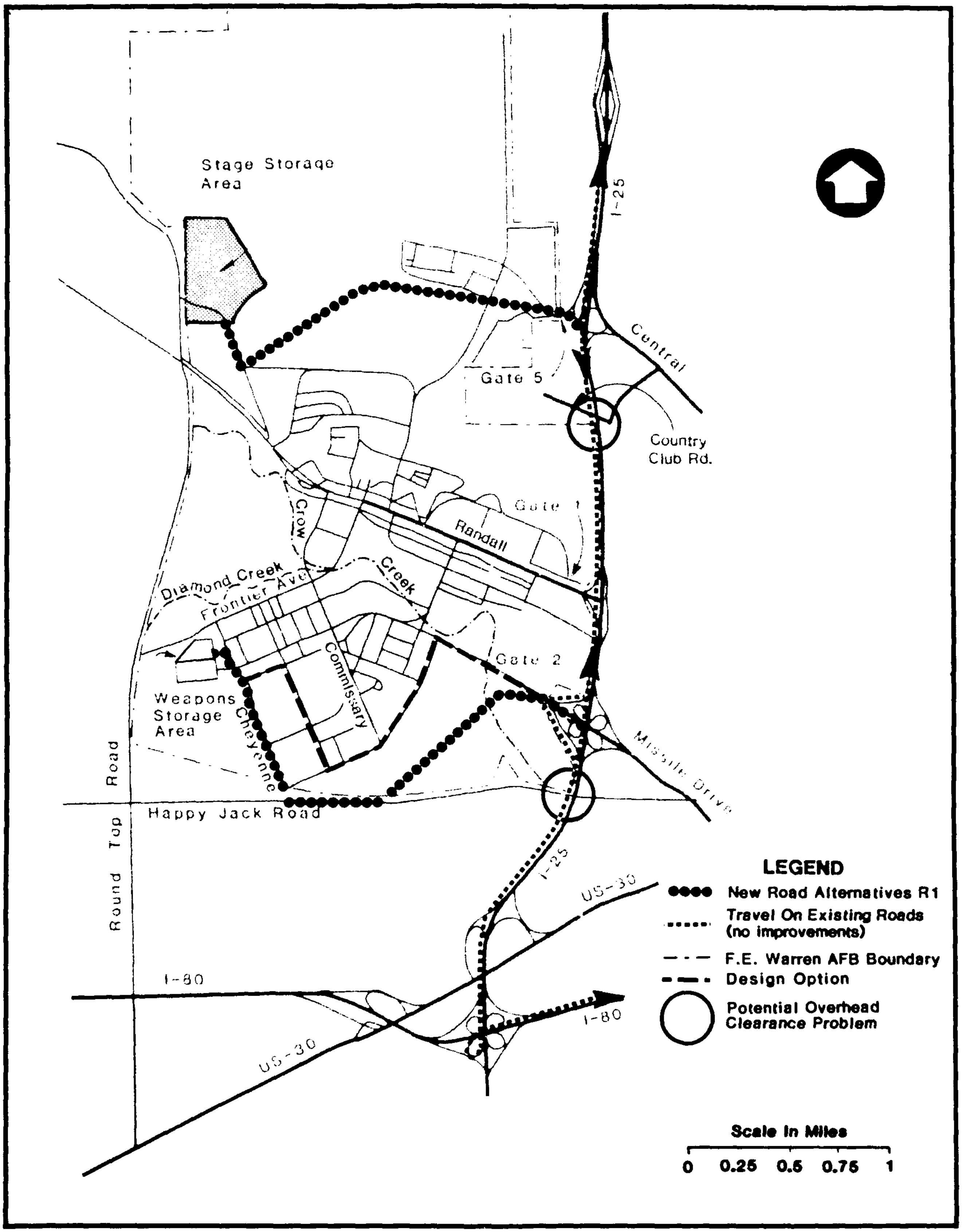


PEACEKEEPER DEPLOYMENT AREA FIGURE NO. 1.1-1



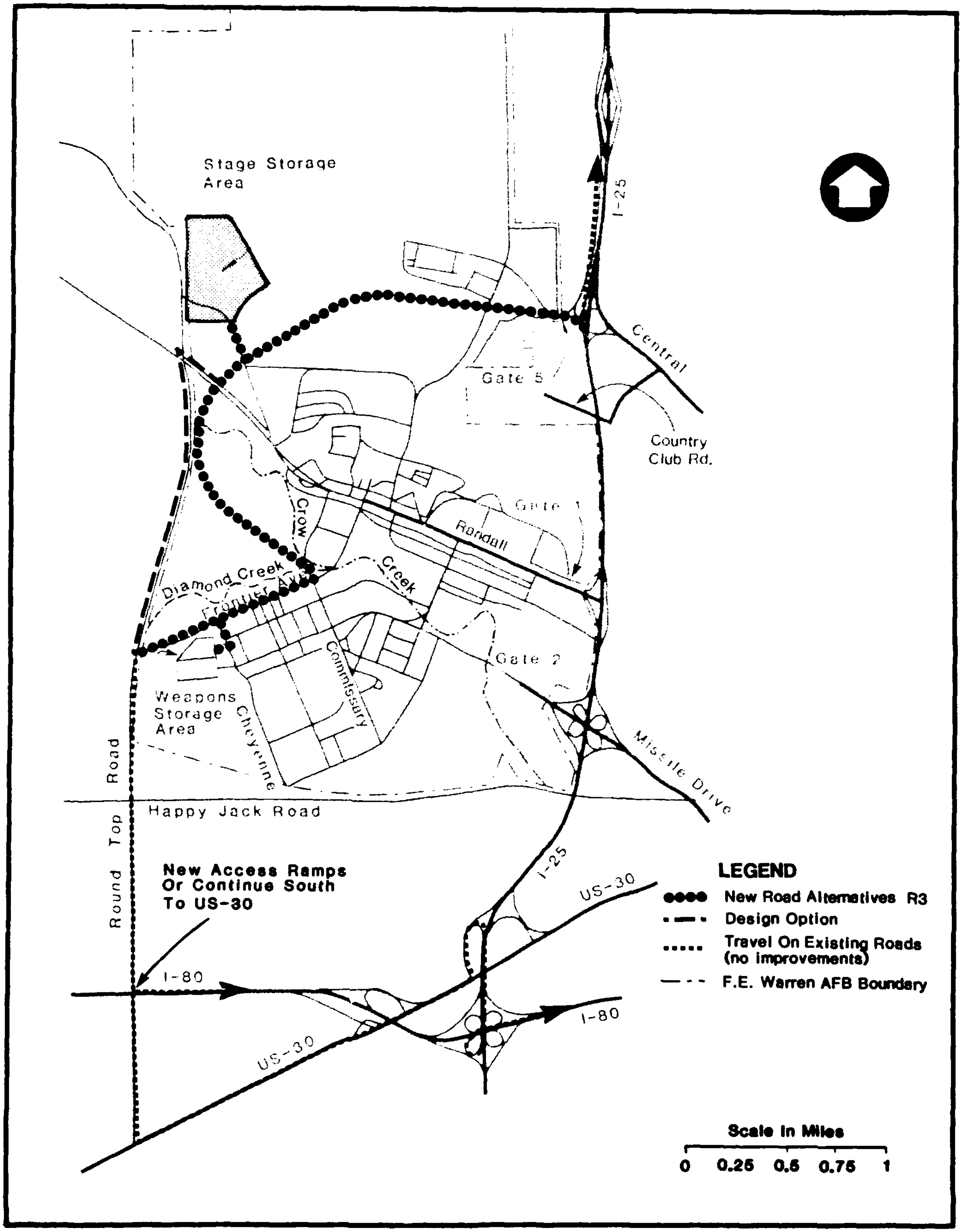
NEW ROADS AT F.E. WARREN AFB: PROPOSED ACTION R2

FIGURE NO. 1.1-2



NEW ROADS AT F.E. WARREN AFB: ALTERNATIVE R1

FIGURE NO. 1.1-3



NEW ROADS AT F.E. WARREN AFB: ALTERNATIVE: R3

FIGURE NO. 1.1-4

three alternatives, is proposed to link Peacekeeper facilities onbase and to provide improved access to or from the base (Figures 1.1-2, 1.1-3, and 1.1-4).

Work in the Deployment Area will take place between 1985 and 1989. Many of the access roads to the Launch Facilities will be upgraded. Bridge clearance problems will be corrected, and some culverts and bridges may need to be upgraded. Below-ground modifications will be related to removal of Minuteman support hardware, insertion of a protective canister to enclose the Peacekeeper, and installation of communications systems and support equipment.

A total of 11 alternatives have been chosen as candidate routes for communication connectivity between Squadrons 319 and 400 (Figure 1.1-5). Five routes will be selected for installation. Total buried cable length will range from approximately 82 to 110 miles, depending upon final route selections.

Under the Proposed Action two dispatch stations would be established, one each in the northern and eastern portions of the Deployment Area. Although actual locations have not been selected, Chugwater, Wyoming and Kimball, Nebraska are representative locations analyzed in the Final Environmental Impact Statement and in this EPTR. Dispatch stations would be not more than 5 acres in size and would be used for the temporary open storage of equipment and material. One or more buildings would also be present at each site for contractor use as office space. All dispatch stations would be removed prior to project completion. In addition to the Proposed Action, two alternatives are considered in this environmental impact assessment:

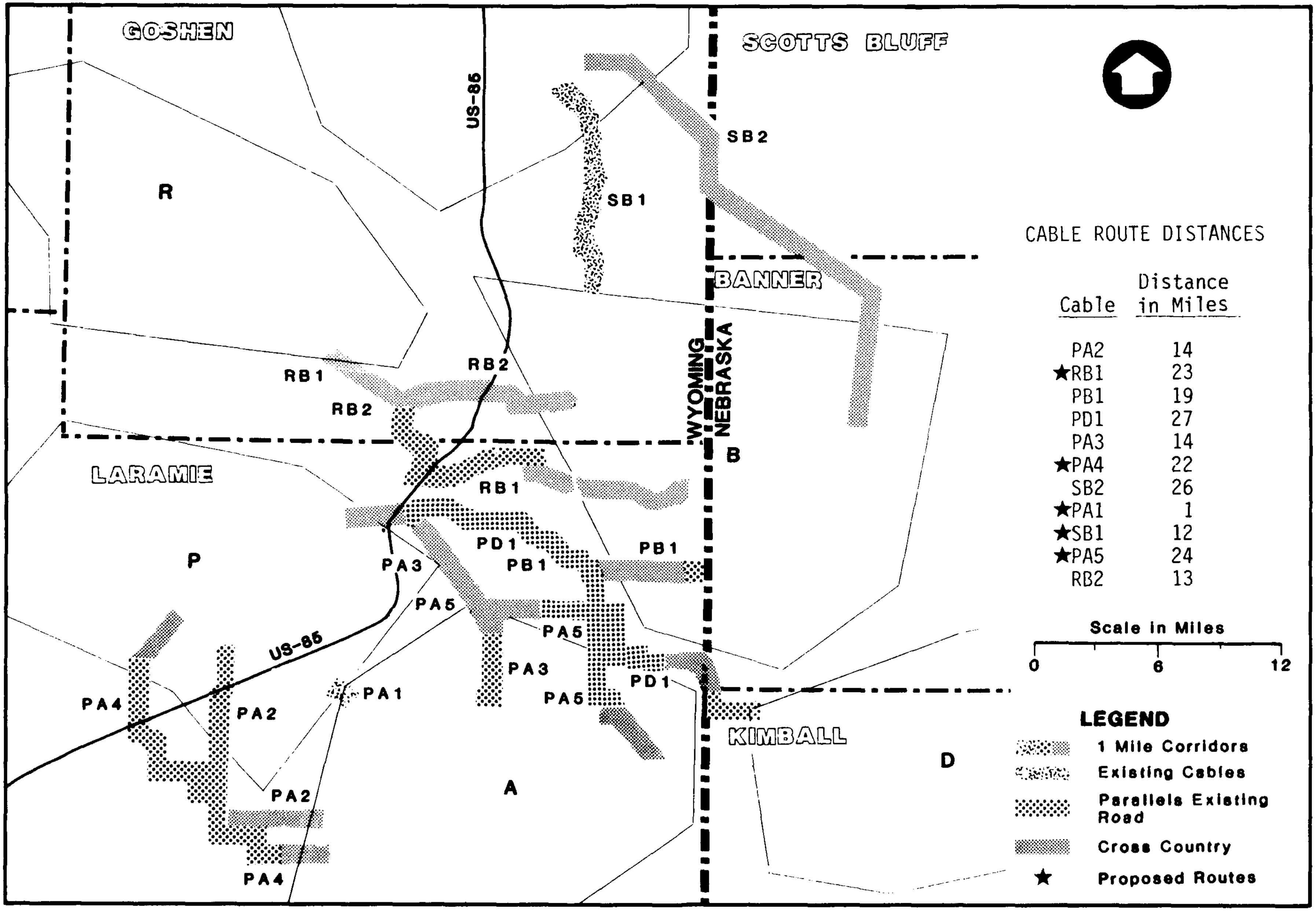
1) One dispatch station only, in the eastern part of the Deployment Area; or

2) No dispatch stations.

Two options have been identified for resurfacing Deployment Area roads. Surfacing Option A involves gravel upgrades of 252 miles of existing gravel roads and the paving or repaving of 390 additional miles of gravel and asphalt roads. Surfacing Option B involves the paving or repaving of all 642 miles of gravel and asphalt roads listed in Surfacing Option A.

Direct manpower for construction, assembly and checkout, and operation of the system will peak during 1986 when an average of nearly 1,600 persons will be required. In 1991, following deployment, the remaining increased operational workforce at F.E. Warren AFB will consist of about 475 persons. Table 1.1-1 presents the average annual workforce, based on quarterly estimates for each year of construction.

Table 1.1-2 shows the average number of jobs including those which are considered to be filled by available labor; as well as those filled by weekly commuters and inmigrants, on an annual average basis. In general, locally available labor will fill all the road and construction jobs.



CABLE ROUTE DISTANCES

Cable	Distance in Miles
PA2	14
★RB1	23
PB1	19
PD1	27
PA3	14
★PA4	22
SB2	26
★PA1	1
★SB1	12
★PA5	24
RB2	13

ALTERNATIVE CABLE ROUTES

FIGURE 1.1-5

Table 1.1-1

PROJECT AVERAGE MANPOWER REQUIREMENTS BY YEAR[1]

	1984	1985	1986	1987	1988	1989	1990	1991
Deployment Area								
Construction	5	40	60	60	40	0	0	0
Assembly and Checkout	0	15	210	285	265	265	10	0
Operations	0	0	0	0	0	0	0	0
Defense Access Road	0	275	315	150	0	0	0	0
Subtotal	5	330	585	495	305	265	10	0
Operating Base								
Construction	100	630	70	0	0	0	0	0
Assembly and Checkout	40	130	525	555	515	510	22	0
Operations	0	130	415	490	500	500	475	475
Subtotal	140	890	1,010	1,045	1,015	1,010	497	475
TOTAL:	145	1,220	1,595	1,540	1,320	1,275	507	475

Note: [1] Estimates based on average quarterly employment.

Table 1.1-2

TOTAL JOBS, LOCAL AND REGIONAL HIRES, AND INMIGRATION FOR THE EMPLOYMENT DEMAND REGION OF INFLUENCE

	1984	1985	1986	1987	1988	1989	1990	1991 and beyond
1) Total (Direct/ Indirect) Additional Jobs	250	2,400	2,675	2,550	2,025	1,825	650	590
2) Average Annual Local Hires	157	1,750	1,525	1,350	1,100	815	225	230
3) Average Annual Weekly Commuters	25	225	175	100	25	10	0	0
4) Average Annual Inmigrant Workers	75	425	950	1,100	925	1,000	425	360
5) Unsuccessful Job-Seekers	30	185	180	150	165	110	70	0
6) Inmigrant[1] Population	275	1,475	2,875	3,200	3,025	2,875	1,200	925

Note: [1] Includes inmigrants, workers, and unsuccessful job-seekers.

As a result of the purchase of materials in the project area and the local expenditures of project employees, additional jobs will be created in the region. These jobs are estimated to number as follows:

Year:	1984	1985	1986	1987	1988	1989	1990	1991 & on
Indirect Jobs:	105	1,180	1,080	1,010	705	550	143	115

Estimated materials and costs for the project, based on total project budgetary considerations, are shown by Standard Industrial Classification in Table 1.1-3.

A number of construction and support materials will be obtained from sources within the project area. Among the materials exerting a major influence on assessment of project impacts are aggregate (4.6 million tons), water (516 acre-feet), fuel (7.6 million gallons), and electricity (3.8 million kWh). In the case of water supply for construction, the Air Force will identify and, if necessary, obtain permits for the water or purchase existing water rights.

1.2 Description of Resource

Noise is defined as any sound (i.e., rapid change of air pressure waves) considered to be undesirable. The noise sources evaluated are vehicular, air, and railroad transportation, and construction activity.

Table 1.1-3

ESTIMATED MATERIAL REQUIREMENTS
BY STANDARD INDUSTRIAL CLASSIFICATION

Industrial Classification	Estimated 1982 Dollars (1,000s)
Fabricated Structural Metal	$22,999
Unclassified Professional Services and Products	14,358
Cement and Concrete Products	10,862
General Wholesale Trade	8,890
Structural Metal Products[1]	11,983
Millwork, Plywood, and Wood Products[1]	3,941
Copper, Copper Products	3,902
Electrical Lighting and Wiring	3,871
Stone and Clay Mining and Quarrying	39,728
Stone and Clay Products[1]	2,955
Basic Steel Products	1,233
Heating and Air Conditioning Apparatus	1,525
Plumbing and Plumbing Fixtures	938
Petroleum Refining and Products	5,148
Material Handling Equipment	1,970
Sawmills and Planing Mills	1,478
Paints and Allied Products	1,478
Plastic Products[1]	1,478
Furniture and Fixtures	986
Structural Clay Products	986
General Hardware	986
Scientific Instruments	986
Rail Transport	986
Real Estate	986
Construction, Mining, and Oilfield Machinery	749
TOTAL:	$145,402

Note: [1] Not included in other Industrial Classifications.

2.0

AFFECTED ENVIRONMENT

2.0 AFFECTED ENVIRONMENT

2.1 General

Due to the low population density and a correspondingly lower level of transportation and construction activity in the project area, background noise levels can be considered generally low in both the urban and rural areas.

The noise sources evaluated for this environmental planning technical report (EPTR) include vehicular, air and railroad transportation, and construction activity. An ambient noise monitoring program was conducted to determine existing noise levels adjacent to major roadway segments and other noise generating sources. A discussion of this program is presented in Appendix A. The determination of "major" for the noise analysis was based upon the volume of existing traffic, the location of noise sensitive receptors adjacent to the source, and the propensity of increased project-related use in the future. Projections of future noise levels were performed using standard analytic models and procedures. In addition, a qualitative assessment of noise impacts associated with the project-related construction activity is also included as part of this study.

2.2 Project Requirements

Overall project requirements are outlined in Section 1.1.

2.3 Region of Influence

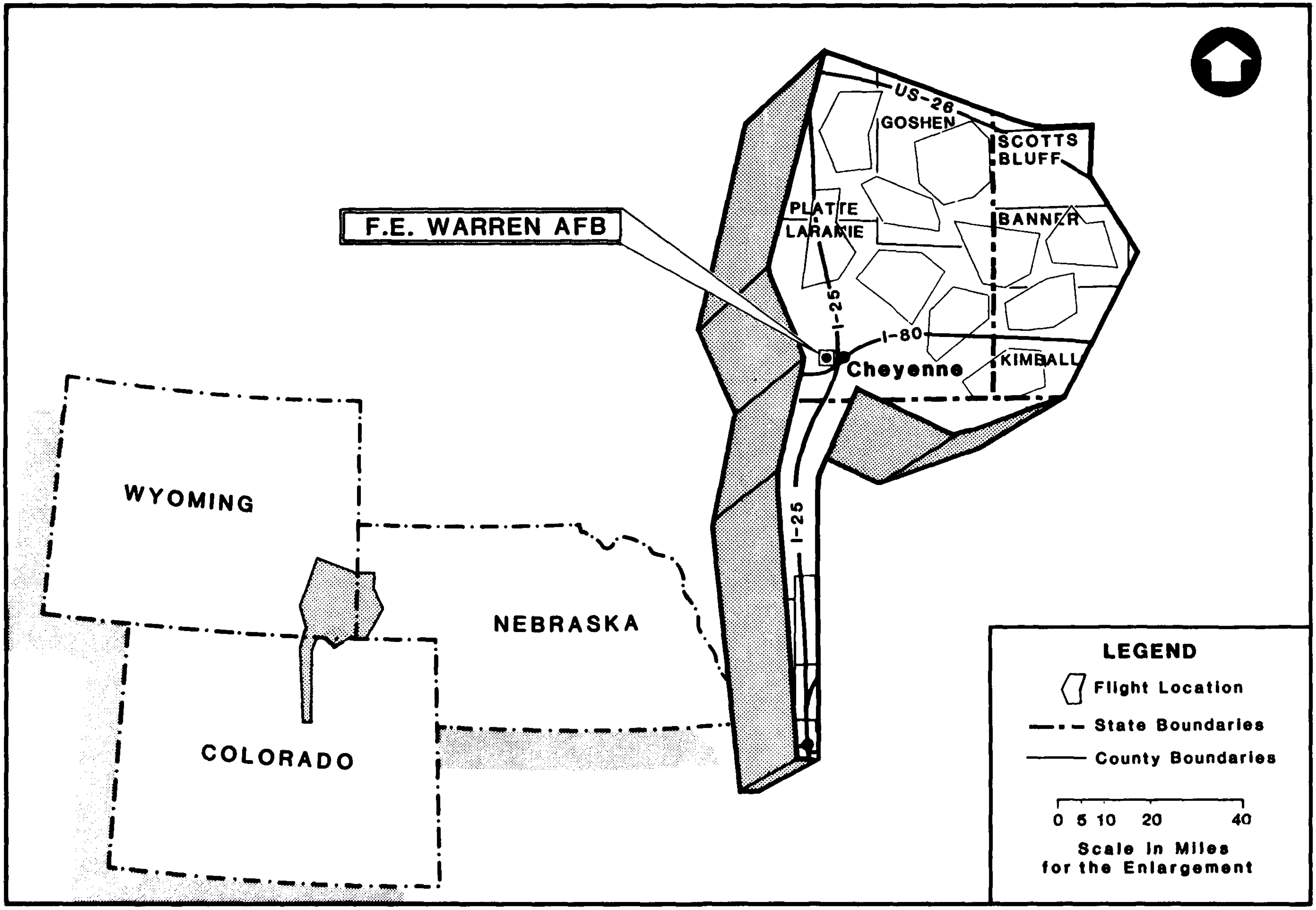
2.3.1 Definition

The Region of Influence (ROI) for noise is broadly defined as that part of the project area in which noise level increases can potentially occur. These locations include construction sites at F.E. Warren AFB; affected silos, access roads, and cable trench paths within the Deployment Area (DA); interstate highways; and principal traffic arterials. Figure 2.3-1 presents the ROI for noise.

The Area of Concentrated Study (ACS) within the ROI includes F.E. Warren AFB; Cheyenne, Wheatland, and Chugwater Wyoming; Kimball, Nebraska; areas where existing noise levels are high; and areas projected to be impacted by future trends or project-related noise sources. A more detailed description and justification of the ACS is provided in Section 3.0.

2.3.2 Justification

The U.S. Environmental Protection Agency (EPA) and Federal Highway Administration (FHWA) have defined noise level increase limits from vehicular traffic in residential areas and noise-sensitive areas such as around nursing homes, schools, hospitals, churches, and other areas where the preservation of reduced noise levels is important. These noise level limitations are described in terms of 65-L_{eq} values. The Federal Aviation Administration (FAA) has developed recommendations for airport operations at airport boundaries of 65 L_{dn}. Specific noise standards for railroads have not been promulgated; however, for purposes of this study, noise from railroad operations is compared to EPA 65-L_{dn} standards, since these standards were



REGION OF INFLUENCE FOR NOISE

FIGURE NO. 2.3-1

designed to minimize intrusive residential noise levels. The 65-L_{dn} and 65-L_{eq} noise levels are accepted and recognized values used for determination of environmental noise impacts on human receptors. For purposes of comparing various existing and predicted noise level indices, it should be noted that for peak-traffic periods, the L_{eq} is approximately equivalent to the L_{dn} (U.S. Department of Housing and Urban Development 1979).

2.4 Derivation of Data Base

2.4.1 Literature Sources

Numerous documents were used in the preparation of text and evaluation of analytic techniques. These sources are referenced throughout the text and listed in Section 5.0.

2.4.2 Group and Agency Contacts

Information and data relevant to all aspects of the noise analysis have been acquired from the following sources:

EPA, Region VIII, Noise Branch

EPA, Region VII

U.S. Department of Transportation, FHWA

U.S. Department of Transportation, FAA

U.S. Department of Housing and Urban Development

Wyoming Department of Environmental Quality

Wyoming State Highway Department, Environmental Services

Nebraska Department of Environmental Control

Nebraska Department of Health

Nebraska Department of Roads, Project Development Division

Colorado Department of Health, Noise Control Program

City of Cheyenne, Zoning Department

City of Cheyenne, Engineering Department

City of Cheyenne, Planning Department

Union Pacific Railroad

Cheyenne Airport

Bolt, Beranek and Newman, Inc.

Wyle Laboratories

2.4.3 Primary Data

To determine existing noise levels in the project area, ambient noise levels were monitored in the vicinity of the Cheyenne Airport and railroad station yard, and at traffic arterials and intersections in Cheyenne and in the DA. These sites include the following:

Cheyenne, Wyoming:	Interstate 25 Dell Range Boulevard Central Avenue/Fourth Avenue Randall Avenue Prairie Avenue Cheyenne Airport vicinity Cheyenne Railroad Station Yard vicinity
Wheatland, Wyoming:	Interstate 25/South Street West C Street
Torrington, Wyoming:	(Route 159)
Kimball, Nebraska:	Route 71
Scottsbluff, Nebraska:	20th Street (Route 29) Broadway (Route 71)
Gering, Nebraska:	M Street (Route 92)

Noise levels were monitored at these sites for 1-hour periods corresponding to the hour of peak traffic operations and, where applicable, concurrent classification traffic counts were also recorded to determine relative percentages of automobiles and medium and heavy-duty trucks. The monitoring was conducted using a B&K Type 4426 Noise Analyzer and Statistical Processer with the microphone 5 feet above ground, corresponding to the approximate height of a human receptor. A more detailed description of the noise monitoring program and monitoring site locations is contained in Appendix A.

2.5 Analytic Methods For Existing Conditions

The selection of specific models and methodologies for assessing environmental noise are dependent upon the following criteria:

- o Scale of the project;
- o Geophysical conditions of the project area;
- o Determination of noise sources;
- o Level of assessment; and
- o Regulatory agency coordination.

The scale of a project is used to determine the anticipated range of the area potentially impacted and, hence, the type of model to be employed. Typically for noise analysis, models that can accurately predict localized impacts are chosen, since noise levels attenuate rather rapidly with distance.

The geophysical conditions of the project are also important to model selection. The propagation of noise levels from a source is very sensitive to alterations of topography and applicable models must allow such incorporation. The noise model selected in this report to assess vehicular noise, STAMINA 2.0, allows very accurate simulation of site topography.

The determination of the noise source is a function of the types of activity associated with the specific project to be assessed, and in turn, affects the type of assessment model to be employed. For the purposes of this study, project-related transportation sources of noise were considered primary. Hence, specific models to assess vehicular, air, and rail sources were selected. Since construction activity is a major component of the project, at least in respect to facility construction at F.E. Warren AFB and potential induced residential development in Cheyenne, a qualitative approach to determine construction noise impacts has been developed. Large construction projects also typically result in increased vehicular traffic on area roadways from construction vehicles, workforce commuter traffic, and project-induced population increases, which result in the need to assess the increased noise levels along the affected roadways.

The level of assessment desired for impact evaluation is also critical in model selection. It is often desirable to screen specific impact areas to determine the potential for impacts to occur. The selection process to determine those roadways that were analytically evaluated was based on the percent increase in traffic volumes anticipated due to project implementation. Generally speaking, those roadway segments projected to have 10 percent or greater project-related increases in traffic volumes were selected for evaluation. Ten percent was selected as a conservative threshold value since traffic volume increases of less than 10 percent rarely produce a perceived increase in noise levels unless truck percentages increase significantly, a condition not anticipated with this project.

The final factor, regulatory agency coordination, is also important in model selection. Coordination with federal, state, and local regulatory agencies may indicate agency preference for one model versus another. As a result of this type of coordination in the present study, the EPA requested specific parameters, namely L_{eq} noise levels, to be addressed as part of the noise study (EPA 1983).

These criteria have been applied in the selection of the appropriate analytic methods for assessing both the existing noise environment and the future noise environment associated with the Proposed Action, project element alternatives and the No Action Alternative.

2.5.1 Vehicular Noise

The FHWA's STAMINA 2.0 computerized noise model was used to predict existing noise levels resulting from motor vehicle operation (FHWA 1982a). This EPA-accepted model predicts noise levels from light-duty vehicles (autos and light trucks), medium-duty vehicles (two-axle, six-tire trucks), and heavy-duty vehicles (trucks with more than two axles).

STAMINA 2.0 incorporates data on vehicle volumes, vehicle speeds, and the physical characteristics of the roadway and surrounding environment into the calculation of noise level values. The predicted peak hour volumes used in the analysis are provided in Table 2.5-1. Additionally, calculations for roadway grade, reflective and absorptive barriers, ground cover, and adjustments for noise levels as they may vary over distances are also components of this model. A detailed description of the STAMINA 2.0 noise prediction model is contained in Appendix B.

The primary data collected as part of the ambient noise monitoring program are presented in Appendix A. It includes not only noise levels but also simultaneous counts of vehicles classified according to light, medium, or heavy-duty categories. These data were used to calibrate the STAMINA 2.0 model as a check to assure proper and accurate simulation modeling of the roadway geometries and site topography.

The calibration procedures and additional sensitivity runs based on traffic data provided by the transportation task group provided some general guidelines for use of the model in the Cheyenne area:

- Selection of a value for noise attenuation purposes within the model (i.e., representative of general surface characteristics) should fall midway between a hard and a soft surface.

- Only basic roadway geometries need to be input into the model. The options for trees, buildings, and reflection calculations were not incorporated and are not necessary to adequately simulate the worst-case noise levels for the first row of homes along a roadway.

- Traffic volume increases of 10 percent or less will produce incremental changes of only 1 dBA or less, even for Interstates 80 and 25, which have relatively high percentages of trucks.

- Critical lengths of roadway segments, i.e., the length at which STAMINA 2.0 modeling predicts maximum noise levels, were determined to be 2,000 feet for Interstates 80 and 25, and 1,000 feet for all other roadways. Receptor points to which actual predictions were made were located perpendicular to the midpoints of these segments.

In using the STAMINA 2.0 model, roadways were selected for analysis if project-generated traffic volumes increased about 10 percent or greater. Due to the number and length of the roadway segments that fell within this category, simplification of roadway geometries was essential. Noise levels were based on generic segments of straight flat roadways with lengths of 1,000 or 2,000 feet, and specific segments of curved roads or roadways with a grade of 2.5 percent or greater. For example, most of the noise level contours along Interstate 25 were based upon noise levels for a straight, flat 2,000-foot roadway with a 300-foot right-of-way. Cartesian coordinates for curved sections, such as Dell Range Boulevard between Powder House Road and Prairie Avenue, were carefully plotted in order to accurately model the more complex noise levels at receptor points along these roadway configurations.

Table 2.5-1

CALCULATED PEAK HOUR TRAFFIC VOLUMES AT
SELECTED ROADWAYS (1983)

	Average Daily Traffic	Peak 1-Hour Traffic	Peak 1-Hour Period: Cars	Peak 1-Hour Period: Medium-Duty Trucks	Peak 1-Hour Period: Heavy-Duty Trucks
Cheyenne, Wyoming					
Interstate 25 (Four Mile Road to Central Avenue)	6,400	700	637	16	47
Interstate 25 (Central Avenue to Pershing Boulevard)	13,500	1,500	1,365	34	101
Interstate 25 (Pershing Boulevard to Missile Drive)	13,500	1,500	1,365	34	101
Interstate 25 (Missile Drive to U.S. 30)	10,100	1,100	1,001	25	74
Interstate 25 (U.S. 30 to I-80)	10,100	1,100	1,001	25	74
Interstate 25 (I-80 to College Drive)	10,100	1,100	1,001	25	74
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	10,100	1,100	1,078	17	6
Dell Range Boulevard (Prairie Avenue to Powder House Road)	10,100	1,100	1,078	17	6
Central Avenue (I-25 to Yellowstone Road)	12,700	1,400	1,372	21	7
Central Avenue (Yellowstone Road to Warren Avenue)	18,700	2,050	2,009	31	10
Central Avenue (Warren Avenue to Pershing Boulevard)	8,000	900	882	13	5
Warren Avenue (Central Avenue to Pershing Boulevard)	8,000	900	882	13	5
Pershing Boulevard (I-25 to Snyder Avenue)	7,400	800	784	12	4
Pershing Boulevard (Snyder Avenue to Carey Avenue)	8,000	900	[illegible]	13	5
Pershing Boulevard (Carey Avenue to Central Avenue)	8,500	950	[illegible]	14	5
Pershing Boulevard (Central Avenue to Warren Avenue)	10,600	1,150	1,127	17	6
Pershing Boulevard (Evans Avenue to Morrie Avenue)	18,000	2,000	1,960	30	10

Table 2.5-1 Continued, Page 2 of 3

CALCULATED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1983)

			Peak 1-Hour Period		
	Average Daily Traffic	Peak 1-Hour Traffic	Cars	Medium-Duty Trucks	Heavy-Duty Trucks
Pershing Boulevard (Morrie Avenue to Logan Avenue)	15,400	1,700	1,666	25	9
Pershing Boulevard (Logan Avenue to Converse Avenue)	12,700	1,400	1,372	21	7
Pershing Boulevard (Converse Avenue to Windmill Road)	15,000	1,650	1,617	25	8
Pershing Boulevard (Ridge Road to U.S. 30)	6,400	700	686	10	4
Interstate 80 (I-25 to I-180)	6,400	700	595	26	79
Interstate 80 (I-180 to College Drive)	5,800	650	553	24	73
College Drive (I-25 to Parsley Boulevard)	3,500	400	392	6	2
College Drive (Parsley Boulevard to Walterscheid Boulevard)	4,700	500	490	7	3
College Drive (Walterscheid Boulevard to U.S. 85)	4,700	500	490	7	3
Fox Farm Road (U.S. 85 to Avenue C)	3,800	400	392	6	2
Fox Farm Road (Avenue C to College Drive)	3,800	400	392	6	2
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	5,800	650	637	10	3
Ridge Road (Four Mile Road to Dell Range Boulevard)	5,500	600	588	9	3
Lincolnway (Pershing Boulevard to Ridge Road)	7,300	800	784	12	4
Lincolnway (Logan Avenue to Morrie Avenue)	20,000	2,200	2,156	33	11
Parsley Boulevard (I-80 to Ames Avenue)	4,200	450	441	7	2
Missile Drive (I-25 to 20th Street)	5,700	650	637	10	3

Table 2.5-1 Continued, Page 3 of 3

CALCULATED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1983)

	Average Daily Traffic	Peak 1-Hour Traffic	Peak 1-Hour Period: Cars	Medium-Duty Trucks	Heavy-Duty Trucks
Evans Avenue (8th Avenue to Pershing Boulevard)	7,700	850	833	13	4
Ames Avenue (Parsley Boulevard to 20th Street)	10,400	1,150	1,127	17	6
20th Street (Logan Avenue to Morrie Avenue)	5,700	650	637	10	3
20th Street (Snyder Avenue to Ames Avenue)	4,200	450	441	7	2
Kimball, Nebraska					
U.S. 30	4,330	476	447	15	14
Route 71	2,580	284	267	9	8
Wheatland, Wyoming					
16th Street	8,240	906	852	27	27
South Street	11,180	1,230	1,156	37	37

Traffic data for baseline and future years were provided by the transportation task group. The vehicular mix (light, medium, and heavy-duty vehicle percentages) was the same for baseline and future years under all alternatives.

The directional split of traffic on roadways for the peak hour, provided by the transportation task group, was 60/40. It was conservatively assumed that the traffic lanes with the 60 percent traffic volume would be closest to the receptor. For roadways with a right-of-way of 100 feet or less, traffic in both directions were added together and modeled as a single roadway. For roadways with a wider right-of-way and roadways with a grade of 2.5 percent or greater, the traffic in each direction was modeled as a separate roadway.

Receptors were placed on a roadway segment's midpoint at the right-of-way boundary and at 100 and 200 feet from the right-of-way boundary. For straight roadways, the receptors were placed on the side of the road which experienced the highest (i.e., 60 percent) volume of traffic. For curved roads, receptors were placed at numerous points within 200 feet of the road, and the highest noise level for each side of the road was reported and used for graphics. Because the output from STAMINA 2.0 shows noise levels only at the specified receptor points, semilog graph paper was used to interpolate the distance to the appropriate L_{eq} contours.

Noise level impacts were simplified slightly for presentation in tables and graphics. If two adjacent segments of the same roadway showed noise levels at specific receptor points to be within 1 dBA of each other, the higher of the two values was used for both segments. This included sections of road with grades of up to 5.5 percent which were usually within 1 dBA of the adjacent flat segments.

The 65-L_{eq} noise contour was used to determine the location of existing high noise levels. The impacted population was determined by counting the number of homes that fell within the 65-L_{eq} noise contour and using a multiplier of 2.5 persons per dwelling unit as provided by the socioeconomics task group.

2.5.2 Air Traffic Noise

The only major airport in the project area is Cheyenne Airport in Cheyenne, Wyoming. Existing noise levels for the Cheyenne Airport were preliminarily screened and evaluated using an FAA airport noise exposure contouring procedure developed by Bolt, Beranek and Newman, Inc. in 1975 and updated in 1982 (Bolt, Beranek and Newman Inc. 1975). This procedure uses hand calculations to determine airport noise on the basis of total operations of jet and propeller aircraft, exclusive of helicopters, during an annual period. Helicopter operations cannot be incorporated into the model and therefore were not assessed as part of the airport noise analysis. The model includes adjustment factors that can be used to refine it to the specific airport. These adjustments include runway utilization, the percentage of jet and propeller operations between 10:00 PM and 7:00 AM, twin engine operations as a percentage of all propeller operations, turbojet operations as a percentage of all jet operations, and a variety of coefficients to be used for specific aircraft types. Jet and propeller operations for each runway enable the user to select the appropriate set of noise contours to overlay onto an airport aerial photograph. A more detailed description of the FAA airport noise exposure contouring procedure is contained in Appendix B.

Although the model was not developed for use in analyzing airports with a large number of commercial or military operations, its simplicity makes it a useful screening tool. The model was used to compare the relative impacts among scenarios, and to thereby determine if a more sophisticated and complex computer model should be employed.

The transportation task group provided estimates of annual operations for baseline and future years for both the Proposed Action and the No Action Alternative. This included a breakdown of operations into the categories of commercial propeller, general aviation propeller, commercial jets, general aviation jets, C-130s, and helicopters. For modeling purposes, a takeoff and landing are each counted as an individual operation.

The 3 runways at the airport are 8/26, 12/30, and 16/34. According to the Airport Manager, Runway 8/26 handles 60 percent of the annual operations, Runway 12/30 handles 30 percent of the annual operations, and Runway 16/34 handles 10 percent of the annual operations. Because Runway 16/34 does not handle jet aircraft, 60 percent of the jet operations were allocated to Runway 8/26 and 40 percent of the jet operations were allocated to Runway 12/30. Since Runway 16/34 is used 10 percent of the time, a number equal to 10 percent of the total operations was assigned to this runway as propeller operations. Remaining propeller operations were split between Runways 8/26 and 12/30, 60 percent and 40 percent, respectively (Cheyenne Airport 1983). This method of assigning operations to runways was carried out for each of the years analyzed.

Runway utilization is another factor to be considered in selecting the contours for each runway. The utilization for Runway 8/26 is 35 percent and 65 percent, respectively, because 65 percent of the operations on this runway occur at the eastern end on Runway 26. For the other 2 runways, the split is equal, 50 percent and 50 percent. Since the procedure does not account for every possible runway utilization ratio, the closest approximate set of utilization ranges and corresponding noise level contours was selected. For Runway 8/26, the contours representing a 25 percent and 75 percent split, respectively, were used.

Propeller operations were analyzed first. Information from the Airport Manager (Cheyenne Airport 1983) indicated that approximately 8 percent of the propeller operations were twin engine, which yielded an adjustment factor for nonmilitary aircraft of 1.06. The airport control tower closes at 10:00 PM, so few, if any, operations take place between 10:00 PM and 7:00 AM. Therefore, no nighttime adjustment factor for the L_{dn} was necessary. The adjustment factor for the C-130 aircraft operations was a multiplier of 9.0.

In the analysis of jet aircraft, no adjustments were made for nighttime operations (10:00 PM to 7:00 AM) or for larger aircraft. National averages were used to determine the percentage of turbojet operations as a percentage of business jet operations. The proportion of turbojets represents a decreasing trend nationally. Bolt, Beranek and Newman, Inc. (1983) provided updated turbojet adjustment factors for business (general aviation) jets for 1983 through 1991 and these factors were incorporated into the analysis.

The sizes of the L_{dn} noise level contours resulting from jet operations were substantially larger than the contours for the propeller operations. Addition of the propeller contours to the jet contours produced a negligible change in noise levels and the impacts due to propeller operations were dropped from further analysis.

Only the 65 and 70-L_{dn} contours were used in estimating impacts. In all cases, the 70-L_{dn} contours did not extend beyond the airport property. To determine the impacts for each scenario, the relevant noise level contours were superimposed onto an aerial photograph of Cheyenne and the number of homes within the 65-L_{dn} contour was counted. A multiplier of 2.5 persons per dwelling unit was used to estimate population impacts.

The primary data presented in Appendix A include noise levels monitored in the vicinity of the airport and concurrent meteorological data. The monitored data, although helpful in determining general ambient noise, were not used directly in the noise contouring procedure since the 1-hour monitoring period was not sufficient to cover a representative range of operations that occur on a daily basis.

2.5.3 Railroad Noise

The only major railroad station in the project area is located in Cheyenne, Wyoming. A procedure developed by Wyle Laboratories for use by railroad companies was used to estimate the Ldn noise contours in the vicinity of the railroad (Wyle Laboratories 1973). This hand calculation procedure uses daily operations as a basis for developing separate sets of noise contours from mainline operations and yard operations.

Calculations for noise due to mainline operations take into account car length, train length, train speed, number of trains per day, use of helper engines, and the proportion of operations occurring at night. Noise contours for yard operations account for hump yard classification, flat yard switching, engine repair facilities, mechanical refrigerator car servicing, nighttime operations, and areas for train arrival, makeup, and departure. The locations of these activities within the yard are modeled as noise centers. A more detailed description of this procedure is contained in Appendix B.

The primary data presented in Appendix A include noise levels monitored in the vicinity of the railroad station and concurrent meteorological data. The monitored data, although helpful in determining general ambient noise, were not used in calibrating the contouring procedure model. This was because the 1-hour monitoring period was not sufficient to cover a representative range of operations that occur on a daily basis, and railroad cars stored on 3 perimeter tracks constituted an effective noise barrier between residential property lines and noise centers within the yard. Such temporary storage of cars on outside tracks is common at the Cheyenne railroad yard. Thus, the Wyle Laboratories procedure may be somewhat conservative (i.e., high) in its determination of noise levels.

Data on daily mainline and yard operations were obtained from the Cheyenne Railroad Station Yardmaster (Union Pacific Railroad 1983). The majority of the operations occur in an area approximately 1,000 feet west and 1,600 feet east of the Interstate 180 viaduct. Yard operations involved flat yard switching rather than hump yard operations. Major noise centers are at the east and west ends of the yard where concentrated switching activities as well as the arrival and departure of trains take place. Repair and servicing activities create another noise center near the middle of the yard, especially in the vicinity of the turntable. Some of these activities occur between 10:00 PM and 7:00 AM, although the peak period of activity is between 7:00 AM and 3:00 PM. A maximum of 600 cars per day are processed through the yard. Mainline operations are based on trains consisting of one-hundred 60-foot long cars traveling at approximately 20 miles per hour (mph).

The Wyle Laboratories procedure enables determination of the distances from noise centers and mainline tracks to a given noise level such as the 65 Ldn. This information was used to draw noise level contours, making appropriate adjustments for overlapping contours from adjacent noise centers. A multiplier of 2.5 persons per dwelling unit was used to estimate population impacts.

2.5.4 Construction Noise

Standard references were reviewed to define noise levels generated by various types of construction activities and various categories of construction equipment (EPA 1971).

2.6 Existing Environmental Conditions

Noise levels are calculated in decibels (dB). A 10-dB increase in noise level will be perceived by the human ear as a doubling in sound level (Bolt, Beranek and Newman, Inc. 1973). Because humans are more sensitive to high frequency sound, noise levels are usually calculated in decibels on the A-weighted scale (dBA). The "A" scale is used to approximate the response of the human ear to sounds (EPA Office of Noise Abatement and Control 1974).

Noise levels are measured in a variety of ways. The L_{eq} is known as the equivalent sound level. It is the level of a noise source which has an amount of acoustic energy equivalent to that contained in the measured time-varying noise for a given time interval. The L_{dn} is the day-night sound level. It is the energy-averaged equivalent level (L_{eq}) for a 24-hour period, but assigns a 10 dBA penalty to noise occurring between the nighttime hours of 10:00 PM and 7:00 AM. Other reference values include the L_{90}, which is the noise level exceeded 90 percent of the time, and the L_{10}, which is the noise level exceeded 10 percent of the time. The L_{10} is frequently used as an indicator of peak noise levels. Ambient noise levels are usually defined by the L_{90}, while the L_{10}, L_{dn}, and L_{eq} have threshold levels that are used to indicate receptor impacts. It should be noted that for peak traffic periods, the L_{dn} is approximately equivalent to the L_{eq}.

Major sources of noise are surface transportation (vehicular and rail), aviation, and construction activity. Consideration and assessment of existing noise effects have primarily focused on transportation-related noise sources.

The effect of vehicular, railway, and air traffic-generated noise can best be assessed through the impact it has on human activities. Activities associated with residential uses will usually be the most sensitive to interference caused by high noise levels. Although considered somewhat subjective, human response to a range of dBA levels can be expected to be fairly uniform. The extent of perceived annoyance to various dBA levels is also contingent upon existing background or ambient noise levels. Noise sources which create high peaks and variations are more readily detected than noises of steady duration and intensity.

2.6.1 Vehicular Noise

Noise associated with road traffic is considered to be relatively constant. It varies in this respect from the intermittent peak noise levels from air and rail traffic. Road traffic noise is also a much more widespread source, and to some extent affects every environment. Actual levels of highway-generated noise will vary with traffic conditions, road design, physical surroundings, weather conditions, and particular vehicle types. Automobiles are usually a relatively minor source of roadside noise. In contrast, heavy trucks and buses are generally the primary contributors to roadway noise levels. Exhaust, engine, and tire noise are the sources of the high noise levels associated with carrying a heavy load, traveling uphill, or accelerating from a stopped position.

The monitored noise level data were used to calibrate the STAMINA 2.0 model, which in turn was used to predict existing noise levels from motor vehicles. The calculated 1983 noise levels for key roadway segments are presented in Table 2.6-1 for varying distances from the roadway right-of-way boundary and are reported as equivalent level (L_{eq}) values. The roadway networks for Cheyenne, Wyoming; Kimball, Nebraska; and Wheatland, Wyoming, are provided in Figures A.1-1, A.1-2, and A.1-3, respectively, in Appendix A. Noise levels on roadway segments along Interstate 25, Prairie Avenue, Central Avenue, Pershing Boulevard, and Windmill Road in Cheyenne; U.S. 30 in Kimball; and 16th Street and South Street in Wheatland, are predicted to exceed 65.0 L_{eq}.

The distance from roadway right-of-way boundaries to the 65-L_{eq} noise level contour and the number of residential buildings and population which fall within the contour are provided in Table 2.6-2. The analysis indicates that approximately 37 dwelling units in Cheyenne along Interstate 25 (between Central Avenue and Pershing Boulevard) with an estimated population of 93 people; and 36 dwelling units along 16th Street and 100 units along South Street in Wheatland with an estimated population of 90 and 250 people, respectively, fall within the 65-L_{eq} noise level contour which extend beyond the right-of-way of these roads.

Aerial photographs of the subject roadway segments in the project area that have been evaluated are included as Appendix C. The 65-L_{eq} noise level contours have been graphically represented on these photographs to indicate roadway noise effects.

2.6.2 Air Traffic Noise

Noise levels for the Cheyenne Airport were estimated using the FAA airport noise contouring procedure. This procedure bases determination of airport noise on total operations of jet and propeller aircraft, exclusive of helicopters, during an annual period. Annual operations data were estimated for 1983 on the basis of historical records and information provided by the Cheyenne Airport Manager (Cheyenne Airport 1983). Estimated airport operations for 1983 are provided in Table 2.6-3.

Table 2.6-1

CALCULATED NOISE LEVELS AT SELECTED RECEPTORS FOR 1983

Roadway Segments	Right-of-Way Boundary (Leq)	Distance From Right-of-Way Line 100 Ft (Leq)	Distance From Right-of-Way Line 200 Ft (Leq)
Cheyenne, Wyoming			
Interstate 25 (Four Mile Road to Central Avenue)	65.1	61.9	59.7
Interstate 25 (Central Avenue to Pershing Boulevard)	68.4	65.2	63.0
Interstate 25 (Pershing Boulevard to Missile Drive)	68.4	65.2	63.0
Interstate 25 (Missile Drive to I-80)	67.1	63.8	61.7
Interstate 25 (I-80 to College Drive)	67.4	64.0	61.5
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	66.2	57.8	54.1
Dell Range Boulevard (Prairie Avenue to Powder House Road)	62.9	57.0	54.1
Central Avenue (I-25 to Yellowstone Road)	65.4	58.1	54.6
Central Avenue (Yellowstone Road to Warren Avenue)	67.1	59.8	56.3
Central Avenue (Warren Avenue to Pershing Boulevard)	63.6	56.3	52.8
Warren Avenue (Central Avenue to Pershing Boulevard)	63.6	56.3	52.8
Pershing Boulevard (I-25 to Snyder Avenue)	63.0	55.7	52.2
Pershing Boulevard (Snyder Avenue to Central Avenue)	63.8	56.5	53.0
Pershing Boulevard (Central Avenue to Warren Avenue)	64.6	57.3	53.8
Pershing Boulevard (Evans Avenue to Morrie Avenue)	66.9	59.7	56.2

Table 2.6-1 Continued, Page 2 of 3

CALCULATED NOISE LEVELS AT SELECTED RECEPTORS FOR 1983

Roadway Segments	Right-of-Way Boundary (Leq)	Distance From Right-of-Way Line 100 Ft (Leq)	Distance From Right-of-Way Line 200 Ft (Leq)
Pershing Boulevard (Morrie Avenue to Logan Avenue)	66.2	59.0	55.5
Pershing Boulevard (Logan Avenue to Converse Avenue)	65.4	58.1	54.6
Pershing Boulevard (Converse Avenue to Windmill Road)	66.1	58.8	55.3
Pershing Boulevard (Ridge Road to U.S. 30)	62.5	55.2	51.7
Interstate 80 (I-25 to College Drive)	65.0	62.3	60.4
College Drive (I-25 to Railroad Tracks)	63.1	55.8	52.3
College Drive (Railroad Tracks to Parsley Boulevard)	64.1	54.2	51.9
College Drive (Parsley Boulevard to Walterscheid Boulevard)	65.0	57.4	53.9
College Drive (Walterscheid Boulevard to U.S. 85)	64.2	56.9	53.4
Fox Farm Road (U.S. 85 to Avenue C)	63.8	56.3	52.8
Fox Farm Road (Avenue C to College Drive)	63.1	55.8	52.3
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	65.1	57.0	54.4
Ridge Road (Four Mile Road to Dell Range Boulevard)	64.8	57.6	54.1
Lincolnway (Pershing Boulevard to Ridge Road)	60.0	57.0	54.9
Lincolnway (Logan Avenue to Morrie Avenue)	64.4	61.4	59.3
Parsley Boulevard (I-80 to Ames Avenue)	60.4	53.1	49.6
Missile Drive (I-25 to 20th Street)	61.4	54.9	51.7

Table 2.6-1 Continued, Page 3 of 3

CALCULATED NOISE LEVELS AT SELECTED RECEPTORS FOR 1983

Roadway Segments	Right-of-Way Boundary (L_{eq})	Distance From Right-of-way Line 100 Ft (L_{eq})	200 Ft (L_{eq})
Evans Avenue (8th Avenue to Pershing Boulevard)	64.8	56.7	53.3
Ames Avenue (Parsley Boulevard to 20th Street)	64.5	57.3	53.8
20th Street (Logan Avenue to Morrie Avenue)	62.0	54.8	51.3
20th Street (Snyder Avenue to Ames Avenue)	60.4	53.1	49.6
Kimball, Nebraska			
U.S. 30	66.6	59.4	55.9
Route 71	64.4	57.1	53.6
Wheatland, Wyoming			
16th Street	69.4	59.4	58.6
South Street	70.8	63.5	60.0

Table 2.6-2

LOCATION OF 65-L_{eq} NOISE LEVEL CONTOURS (1983)

Roadway Segments	Distance (ft) From Right-of-Way[1]	Number of Dwelling Units Within Contour	Estimated Population Within Contour
Cheyenne, Wyoming			
Interstate 25 (Four Mile Road to Central Avenue)	10	0	0
Interstate 25 (Central Avenue to Pershing Boulevard)	110	37	93
Interstate 25 (Pershing Boulevard to Missile Drive)	110	0	0
Interstate 25 (Missile Drive to I-80)	60	0	0
Interstate 25 (I-80 to College Drive)	65	0	0
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	10	0	0
Dell Range Boulevard (Prairie Avenue to Power House Road)	a	0	0
Central Avenue (I-25 to Yellowstone Road)	0	0	0
Central Avenue (Yellowstone Road to Warren Avenue)	20	0	0
Central Avenue (Warren Avenue to Pershing Boulevard)	a	0	0
Warren Avenue (Central Avenue to Pershing Boulevard)	a	0	0
Pershing Boulevard (I-25 to Snyder Avenue)	a	0	0
Pershing Boulevard (Snyder Avenue to Central Avenue)	a	0	0
Pershing Boulevard (Central Avenue to Warren Avenue)	a	0	0

Table 2.6-2 Continued, page 2 of 3

LOCATION OF 65-L_{eq} NOISE LEVEL CONTOURS (1983)

Roadway Segments	Distance (ft) From Right-of-Way[1]	Number of Dwelling Units Within Contour	Estimated Population Within Contour
Pershing Boulevard (Evans Avenue to Morrie Avenue)	15	0	0
Pershing Boulevard (Morrie Avenue to Logan Avenue)	10	0	0
Pershing Boulevard (Logan Avenue to Converse Avenue)	5	0	0
Pershing Boulevard (Converse Avenue to Windmill Road)	10	0	0
Pershing Boulevard (Ridge Road to U.S. 30)	a	0	0
Interstate 80 (I-25 to College Drive)	0	0	0
College Drive (I-25 to Railroad Tracks)	a	0	0
College Drive (Railroad Tracks to Parsley Boulevard)	a	0	0
College Drive (Parsley Boulevard to Walterscheid Boulevard)	0	0	0
College Drive (Walterscheid Boulevard to U.S. 85)	a	0	0
Fox Farm Road (U.S. 85 to Avenue C)	a	0	0
Fox Farm Road (Avenue C to College Drive)	a	0	0
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	0	0	0
Ridge Road (Four Mile Road to Dell Range Boulevard)	0	0	0
Lincolnway (Pershing Boulevard to Ridge Road)	a	0	0

Table 2.6-2 Continued, page 3 of 3

LOCATION OF 65-L_{eq} NOISE LEVEL CONTOURS (1983)

Roadway Segments	Distance (ft) From Right-of-Way[1]	Number of Dwelling Units Within Contour	Estimated Population Within Contour
Lincolnway (Logan Avenue to Morrie Avenue)	a	0	0
Parsley Boulevard (I-80 to Ames Avenue)	a	0	0
Missile Drive (I-25 to 20th Street)	a	0	0
Evans Avenue (8th Avenue to Pershing Boulevard)	a	0	0
Ames Avenue (Parsley Boulevard to 20th Street)	a	0	0
20th Street (Logan Avenue to Morrie Avenue)	a	0	0
20th Street (Snyder Avenue to Ames Avenue)	a	0	0
Kimball, Nebraska			
U.S. 30	10	0	0
Route 71	a	0	0
Wheatland, Wyoming			
16th Street	85	36	90
South Street	105	100	250

Note: 1 Distances rounded to the nearest 5 feet.

a Designates the 65-L_{eq} contour is contained within the right-of-way.

Table 2.6-3

1983 ESTIMATED ANNUAL AIRCRAFT OPERATIONS, CHEYENNE AIRPORT[1]

Runway	Business Jets	Commercial Jets	C-130s	Other Propeller	Total[2]
8/26	7,909	702	4,858	22,078	35,547
12/30	5,273	468	3,239	14,718	23,698
16/34	-----	---	-----	7,482	7,482
TOTAL:	13,182	1,170	8,097	44,278	66,727

Note: 1 Fiscal year (July-June).
2 Does not include helicopter operations.

The calculated 1983 65-L_{dn} noise level contour superimposed over the Cheyenne Airport is provided in Figure 2.6-1. This contour is created primarily by jet aircraft using Runways 8/26 and 12/30. Portions of residential neighborhoods located east, northwest, and south of the airport are within the 65-L_{dn} contour which extends beyond the airport boundary. Approximately 262 dwelling units with an estimated population of 655 fall within this contour. For purposes of comparing the airport L_{dn} values with predicted noise levels from vehicular traffic, it may be noted that the L_{dn} is approximately equivalent to the peak hour L_{eq}.

2.6.3 Railroad Noise

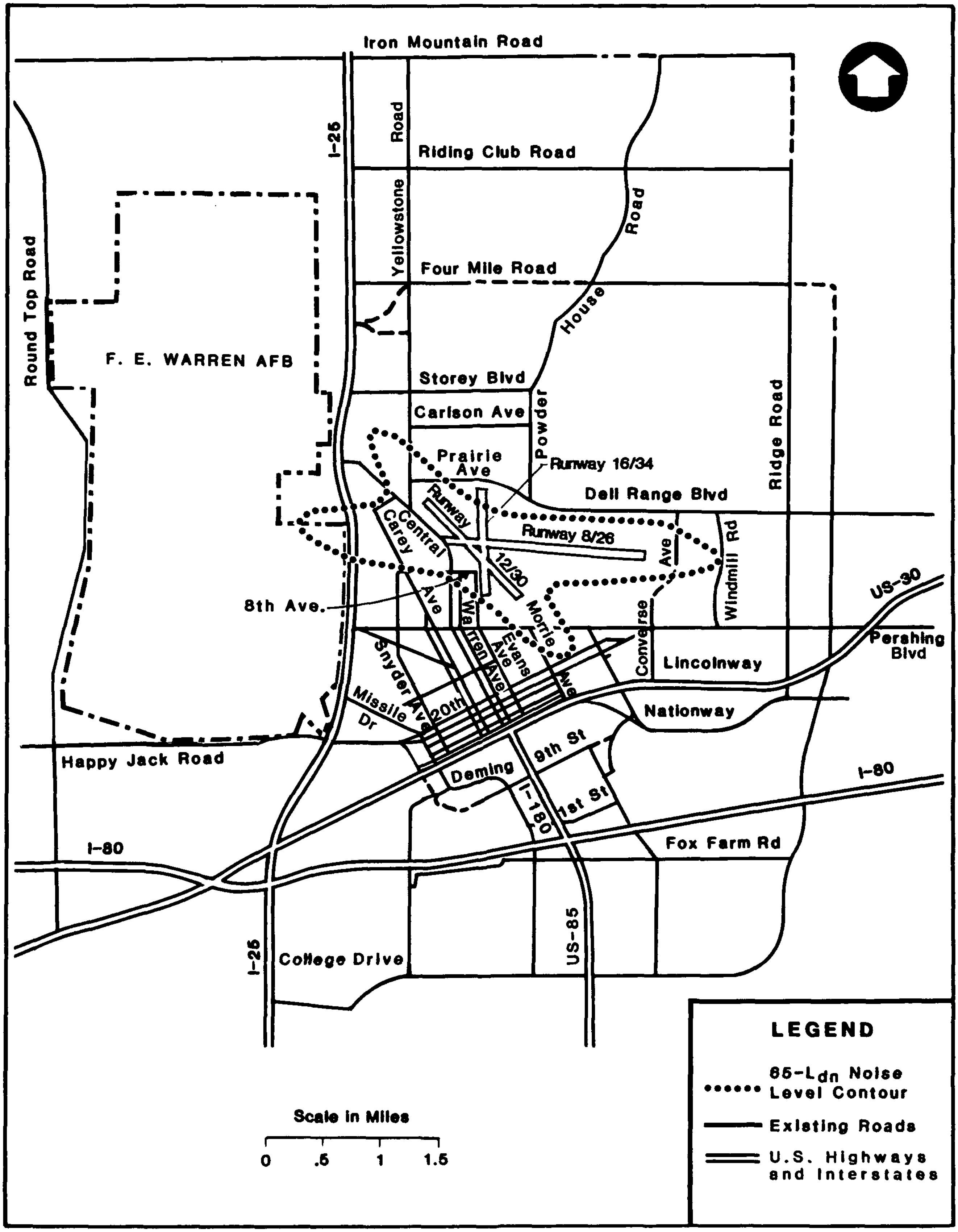
Noise level determinations associated with railroad operations in Cheyenne were based upon both yard and mainline operations. However, the noise centers associated with the yard operations dominate the size and location of the noise contours. Railroad operations in Cheyenne consist of a maximum of 600 cars per day processed at the railroad yard with peak activity occurring between 7:00 AM and 3:00 PM.

Yard operations consist entirely of flat yard switching with most switching activities occurring on tracks south of the train tower and concentrated within an area approximately 1,000 feet west and 1,600 feet east of the Interstate 180 viaduct. The locomotive servicing, repair, and self-load testing activities adjacent to the turntable constitute another major noise center.

The 1983 65-L_{dn} contour is shown in Figure 2.6-2. The results of the Wyle Laboratories analytic procedure indicate that approximately 61 dwelling units (south of the railroad yard) with an estimated population of 153 people fall within the calculated 65-L_{dn} noise level contour which extends beyond the railroad boundary.

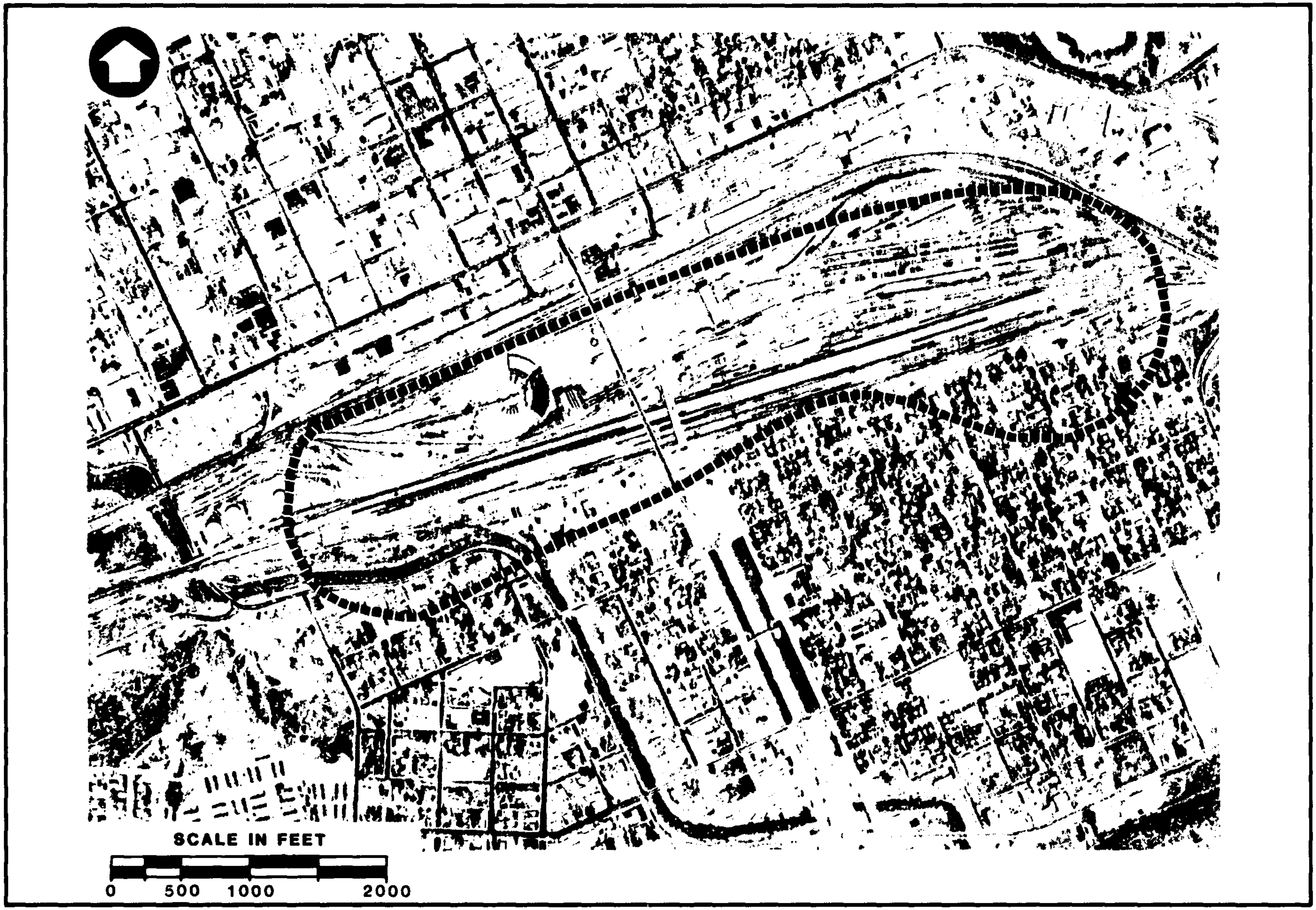
2.6.4 Construction Noise

Construction activities resulting from existing development are occurring within the city of Cheyenne and throughout the project area. The impacts of noise associated with these activities vary in intensity depending upon the level and type of construction, the numbers and type of construction equipment employed, and location of construction sites with respect to proximity of noise sensitive receptors. These activities include roadway upgrading, residential and commercial construction, and topside grading and excavation for irrigation. No assessment of existing construction noise in the project area was undertaken given the paucity of information concerning the above variables. Additionally, construction-generated noise tends to be site specific and temporary with respect to the area of impact. Typical ranges of noise levels, associated with the various phases of the proposed project construction activities and from the various types of construction equipment that will be used, will be no different than that of existing general construction activities within the city of Cheyenne or the DA.



1983 CHEYENNE AIRPORT 65-L_{dn} NOISE LEVEL CONTOUR

FIGURE NO. 2.6-1



1983 CHEYENNE RAILROAD 65-L_{dn} NOISE LEVEL CONTOUR

FIGURE 2.6-2

ENVIRONMENTAL CONSEQUENCES, MITIGATION MEASURES, AND UNAVOIDABLE IMPACTS

3.0 ENVIRONMENTAL CONSEQUENCES, MITIGATION MEASURES, AND UNAVOIDABLE IMPACTS

For the Area of Concentrated Study (ACS) determination, F.E. Warren AFB was included because of the proposed construction activity onbase. Portions of Cheyenne, Wyoming were included as potential sites for project-related construction activity (i.e., induced residential development). Cheyenne is also the location of several major roadway arterials, the airport, and the railroad station. Kimball, Nebraska and Wheatland, Wyoming were included since they represent the location of the largest project-related increase in vehicular operation outside of the Cheyenne area. Additionally, Kimball is also a potential dispatch station site. Chugwater, Wyoming was included since it is a potential site for a dispatch station. Other roadways within the project area which are predicted to convey personnel to the various Launch Facilities (LFs) were included since potential increases in vehicular operation may result in additional noise effects.

In determining more precise locations of potentially impacted areas, the results of noise assessment analyses have been compared to applicable federal and/or state standards and regulations. Local zoning regulations and noise ordinances were also examined. Primary concern was with residences, parks, schools, and other land uses where quiet environments are preferable.

3.1 Analytic Methods

The following sections present the analytic methodologies used in assessing the potential noise impacts of the Proposed Action, project element alternatives and the No Action Alternative. The No Action Alternative assumes no project and is based on anticipated, normal growth within the proposed project area. The peak construction year for the project, 1985, based on traffic volumes and construction activity, was used to analyze short-term impacts (1986 was used for Kimball, Nebraska and Wheatland, Wyoming). Analysis of long-term impacts was based on 1990, a typical project operations year. Impacts determined for 1985 (1986 for Kimball and Wheatland) will be the highest for any of the construction years (short term). Long-term impacts, for operational years, will be no greater than those determined for 1990 because differences in transportation activity after 1990 between the Proposed Action and the No Action Alternative are assumed to remain negligible.

More detailed discussions of the specific methodologies used in this report are presented in Appendix B.

3.1.1 Vehicular Noise

3.1.1.1 Baseline Future - No Action Alternative

As with the assessment of the existing conditions (Section 2.5.1), the Federal Highway Administration's (FHWA) STAMINA 2.0 model was used to determine vehicular noise levels for 1985 and 1990 for the No Action Alternative. Traffic volume projections for these years were supplied by the transportation task group in the form of peak hour volumes. The predicted peak hour traffic volumes for 1985 and 1990 used in the analysis are provided in Tables 3.1-1 and 3.1-2, respectively.

Table 3.1-1

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1985)
NO ACTION ALTERNATIVE

			1-Hour		
Cheyenne, Wyoming	Average Daily Traffic	Peak 1-Hour Traffic	Cars	Medium-Duty Trucks	Heavy-Duty Trucks
Interstate 25 (Four Mile Road to Central Avenue)	9,200	1,000	910	23	67
Interstate 25 (Central Avenue to Pershing Boulevard)	15,750	1,700	1,547	38	115
Interstate 25 (Pershing Boulevard to Missile Drive)	15,750	1,700	1,547	38	115
Interstate 25 (Missile Drive to U.S. 30)	11,800	1,300	1,183	29	88
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	11,750	1,300	1,274	19	7
Dell Range Boulevard (Prairie Avenue to Powder House Road)	11,750	1,300	1,274	19	7
Central Avenue (I-25 to Yellowstone Road)	13,200	1,450	1,421	22	7
Central Avenue (Yellowstone Road to Warren Avenue)	18,700	2,050	2,009	31	10
Pershing Boulevard (Carey Avenue to Central Avenue)	9,100	1,000	980	15	5
Pershing Boulevard (Central Avenue to Warren Avenue)	11,050	1,200	1,176	18	6
Pershing Boulevard (Evans Avenue to Morrie Avenue)	18,250	2,050	2,009	31	10
Pershing Boulevard (Morrie Avenue to Logan Avenue)	17,450	1,900	1,862	28	10
Pershing Boulevard (Logan Avenue to Converse Avenue)	15,000	1,650	1,617	25	8
Pershing Boulevard (Converse Avenue to Windmill Road)	15,200	1,700	1,666	25	9
Pershing Boulevard (Ridge Road to U.S. 30)	7,450	800	784	12	4
College Drive (Parsley Boulevard to Walterscheid Boulevard)	5,950	650	637	10	3

Table 3.1-1 Continued, Page 2 of 2

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1985)
NO ACTION ALTERNATIVE

	Average Daily Traffic	Peak 1-Hour Traffic	1-Hour Cars	1-Hour Medium-Duty Trucks	1-Hour Heavy-Duty Trucks
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	7,000	750	735	11	4
Ridge Road (Four Mile Road to Dell Range Boulevard)	5,500	600	588	9	3
Lincolnway (Pershing Boulevard to Ridge Road)	7,450	800	784	12	4
Lincolnway (Logan Avenue to Morrie Avenue)	21,200	2,200	2,156	33	11
Parsley Boulevard (I-80 to Ames Avenue)	4,300	500	490	7	3
Missile Drive (I-25 to 20th Street)	6,550	750	735	11	4
Evans Avenue (8th Avenue to Pershing Boulevard)	8,100	900	882	13	5
Ames Avenue (Parsley Boulevard to 20th Street)	10,500	1,150	1,127	17	6
20th Street (Logan Avenue to Morrie Avenue)	8,500	950	931	14	5
20th Street (Snyder Avenue to Ames Avenue)	4,400	500	490	7	3
Kimball, Nebraska[1]					
U.S. 30	4,660	513	482	16	15
Route 71	2,780	306	288	9	9
Wheatland, Wyoming[1]					
16th Street	8,730	960	902	29	29
South Street	11,850	1,304	1,226	39	39

Note: 1 Volumes for 1986.

Table 3.1-2

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1990)
NO ACTION ALTERNATIVE/PROPOSED ACTION

	Average Daily Traffic	Peak 1-Hour Traffic	1-Hour Cars	1-Hour Medium-Duty Trucks	1-Hour Heavy-Duty Trucks
Cheyenne, Wyoming					
Interstate 25 (Four Mile Road to Central Avenue)	13,000	1,350	1,229	30	91
Interstate 25 (Central Avenue to Pershing Boulevard)	22,250	2,450	2,230	55	165
Interstate 25 (Pershing Boulevard to Missile Drive)	20,650	2,250	2,048	51	151
Interstate 25 (Missile Drive to U.S. 30)	15,450	1,850	1,684	42	124
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	14,050	1,650	1,617	25	8
Dell Range Boulevard (Prairie Avenue to Powder House Road)	14,050	1,650	1,617	25	8
Central Avenue (I-25 to Yellowstone Road)	15,450	1,800	1,764	27	9
Central Avenue (Yellowstone Road to Warren Avenue)	19,500	2,300	2,254	34	12
Pershing Boulevard (Carey Avenue to Central Avenue)	10,600	1,250	1,225	19	6
Pershing Boulevard (Central Avenue to Warren Avenue)	13,200	1,550	1,519	23	8
Pershing Boulevard (Evans Avenue to Morrie Avenue)	22,900	2,500	2,450	37	13
Pershing Boulevard (Morrie Avenue to Logan Avenue)	22,050	2,400	2,352	36	12
Pershing Boulevard (Logan Avenue to Converse Avenue)	18,200	2,000	1,960	30	10
Pershing Boulevard (Converse Avenue to Windmill Road)	16,100	1,750	1,715	26	9
Pershing Boulevard (Ridge Road to U.S. 30)	12,500	1,350	1,323	20	7
College Drive (Parsley Boulevard to Walterscheid Boulevard)	8,750	950	931	14	5

Table 3.1-2 Continued, Page 2 of 2

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1990)
NO ACTION ALTERNATIVE/PROPOSED ACTION

	Average Daily Traffic	Peak 1-Hour Traffic	1-Hour Cars	1-Hour Medium-Duty Trucks	1-Hour Heavy-Duty Trucks
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	7,300	800	784	12	4
Ridge Road (Four Mile Road to Dell Range Boulevard)	6,250	700	686	10	4
Lincolnway (Pershing Boulevard to Ridge Road)	10,100	1,150	1,127	17	5
Lincolnway (Logan Avenue to Morrie Avenue)	25,250	2,750	2,695	41	14
Parsley Boulevard (I-80 to Ames Avenue)	4,600	500	490	7	3
Missile Drive (I-25 to 20th Street)	8,400	950	931	14	5
Evans Avenue (8th Avenue to Pershing Boulevard)	9,900	1,100	1,078	16	6
Ames Avenue (Parsley Boulevard to 20th Street)	10,900	1,200	1,176	18	6
20th Street (Logan Avenue to Morrie Avenue)	9,550	1,050	1,029	16	5
20th Street (Snyder Avenue to Ames Avenue)	6,950	750	735	11	4
Kimball, Nebraska					
U.S. 30	5,140	566	532	17	17
Route 71	3,060	337	317	10	10
Wheatland, Wyoming					
16th Street	9,450	1,040	978	31	31
South Street	12,840	1,412	1,327	43	42

No further calibration of the STAMINA 2.0 noise program was undertaken for noise projections for future years. The initial calibration, using ambient monitored noise data, was performed for the existing condition assessment and did not need to be retuned for the 1985 and 1990 predictions.

3.1.1.2 Proposed Action

The vehicular noise model, STAMINA 2.0, was also used for prediction of roadway noise levels in 1985 and 1990 for the project. The predicted peak hour traffic volumes for 1985 used in the analysis are provided in Table 3.1-3. The 1990 peak hour values for the project are the same as those for the No Action Alternative, as provided in Table 3.1-2.

3.1.2 Air Traffic Noise

3.1.2.1 Baseline Future - No Action Alternative

The Federal Aviation Administration's (FAA) airport noise exposure contouring procedure, as discussed in Section 2.5.2, was used for future evaluation of L_{dn} noise levels associated with the Cheyenne Airport in 1985 and 1990 for the No Action Alternative.

Predictions of future airport operations were developed by the transportation task group in the form of annual operations. The projected annual operations for the No Action Alternative for 1985 and 1990 are presented in Table 3.1-4.

3.1.2.2 Proposed Action

The FAA airport noise exposure contouring procedure was also used to evaluate the 1985 and 1990 L_{dn} noise level contours for the project. The projected annual air traffic operations for the project are provided in Table 3.1-5.

3.1.3 Railroad Noise

3.1.3.1 Baseline Future - No Action Alternative

Data concerning future operations at the Cheyenne Railroad Station were either not available or predicted to constitute a negligible increase. Therefore, no additional analysis of railroad noise under the No Action Alternative was undertaken. Those railroad noise methodologies discussed in Section 2.5.3 are also applicable for future years.

3.1.3.2 Proposed Action

Since the project resulted in negligible increases in predicted future railroad operations, no noise analysis was performed for the years 1985 and 1990. Those methodologies discussed in Section 2.5.3 are also applicable for determining the noise levels for future years which should remain unchanged from the existing conditions.

Table 3.1-3

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1985)
PROPOSED ACTION

Cheyenne, Wyoming	Average Daily Traffic	Peak 1-Hour Traffic	1-Hour Cars	1-Hour Medium-Duty Trucks	1-Hour Heavy-Duty Trucks
Interstate 25 (Four Mile Road to Central Avenue)	9,550	1,110	1,010	25	75
Interstate 25 (Central Avenue to Pershing Boulevard)	16,350	1,970	1,793	44	133
Interstate 25 (Pershing Boulevard to Missile Drive)	17,540	1,930	1,756	44	130
Interstate 25 (Missile Drive to U.S. 30)	12,250	1,380	1,256	31	93
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	12,200	1,520	1,490	23	7
Dell Range Boulevard (Prairie Avenue to Powder House Road)	12,200	1,520	1,490	23	7
Central Avenue (I-25 to Yellowstone Road)	13,700	1,740	1,705	26	9
Central Avenue (Yellowstone Road to Warren Avenue)	19,400	2,270	2,225	34	11
Pershing Boulevard (Carey Avenue to Central Avenue)	9,450	1,130	1,107	17	6
Pershing Boulevard (Central Avenue to Warren Avenue)	11,450	1,330	1,303	20	7
Pershing Boulevard (Evans Avenue to Morrie Avenue)	18,950	2,270	2,225	34	11
Pershing Boulevard (Morrie Avenue to Logan Avenue)	18,100	2,160	2,117	32	11
Pershing Boulevard (Logan Avenue to Converse Avenue)	15,550	1,830	1,794	28	8
Pershing Boulevard (Converse Avenue to Windmill Road)	15,800	1,970	1,930	30	10
Pershing Boulevard (Ridge Road to U.S. 30)	7,750	920	902	13	5
College Drive (Parsley Boulevard to Walterscheid Boulevard)	6,200	740	725	11	4

Table 3.1-3 Continued, Page 2 of 2

PREDICTED PEAK HOUR TRAFFIC VOLUMES AT SELECTED ROADWAYS (1985)
PROPOSED ACTION

	Average Daily Traffic	Peak 1-Hour Traffic	1-Hour Cars	1-Hour Medium-Duty Trucks	1-Hour Heavy-Duty Trucks
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	7,300	910	892	14	4
Ridge Road (Four Mile Road to Dell Range Boulevard)	5,700	750	735	12	3
Lincolnway (Pershing Boulevard to Ridge Road)	8,250	900	882	13	5
Lincolnway (Logan Avenue to Morrie Avenue)	22,000	2,440	2,391	37	12
Parsley Boulevard (I-80 to Ames Avenue)	4,450	580	568	9	3
Missile Drive (I-25 to 20th Street)	6,800	1,050	1,029	16	5
Evans Avenue (8th Avenue to Pershing Boulevard)	8,400	996	976	15	5
Ames Avenue (Parsley Boulevard to 20th Street)	10,900	1,320	1,294	20	6
20th Street (Logan Avenue to Morrie Avenue)	8,800	1,130	1,107	17	6
20th Street (Snyder Avenue to Ames Avenue)	4,600	500	490	7	3
Kimball, Nebraska[1]					
U.S. 30	5,940	653	614	20	19
Route 71	4,050	446	419	14	13
Wheatland, Wyoming[1]					
16th Street	10,360	1,140	1,072	34	34
South Street	13,490	1,484	1,394	45	45

Note: 1 Volumes for 1986.

Table 3.1-4

1985 AND 1990 ANNUAL PROJECTED AIRCRAFT OPERATIONS
CHEYENNE AIRPORT, NO ACTION ALTERNATIVE[1]

Year	Runway	Business Jets	Commercial Jets	C-130s	Other Propeller	Total[2]
1985	8/26	9,005	82	4,956	29,354	43,397
	12/30	6,003	54	3,304	19,569	28,930
	16/34	-	-	-	8,954	8,954
	TOTAL:	15,008	136	8,260	57,877	81,281
1990	8/26	12,454	104	5,209	40,186	57,953
	12/30	8,302	70	3,472	26,790	38,634
	16/34	-	-	-	11,696	11,696
	TOTAL:	20,756	174	8,681	78,672	108,283

Notes: 1 Fiscal year only (July-June).

2 Does not include helicopter operations.

Table 3.1-5

1985 AND 1990 ANNUAL PROJECTED AIRCRAFT OPERATIONS
CHEYENNE AIRPORT, PROPOSED ACTION[1]

Year	Runway	Business Jets	Commercial Jets	C-130s	Other Propeller	Total[2]
1985	8/26	9,941	82	4,956	32,911	47,890
	12/30	6,627	54	3,304	21,940	31,925
	16/34	-	-	-	9,786	9,786
	TOTAL:	16,568	136	8,260	64,637	89,601
1990	8/26	12,454	104	5,209	40,186	57,953
	12/30	8,302	70	3,472	26,790	38,634
	16/34	-	-	-	11,696	11,696
	TOTAL:	20,756	174	8,681	78,672	108,283

Notes: 1 Fiscal year only (July-June).

2 Does not include helicopter operations.

3.1.4 Construction Noise

3.1.4.1 Baseline Future - No Action Alternative

Standard references were reviewed to define noise levels generated by various types of construction activities and various categories of construction equipment (EPA 1971).

3.1.4.2 Proposed Action

Noise during the construction phase will be caused by a variety of equipment and activities:

1) Vehicular noise resulting from the commuting of construction workers;

2) Vehicular noise from increased truck traffic;

3) Other mobile equipment (dozers, graders, scrapers, pavers, etc.);

4) Stationary equipment (pumps, generators, compressors, etc.); and

5) Materials-handling equipment (cranes, derricks, concrete mixers, etc.).

Because of the extended nature of the construction period and the detailed projections of population and employment, it was possible to project the vehicular volumes associated with 1) and 2) above. The associated noise impacts of vehicular traffic were modeled and are discussed in Section 3.5.1.

Noise impacts from other equipment, 3), 4), and 5), are addressed in this section. Two aspects of the noise sources are important to understand: first, their cyclical nature and second, the cumulative sum of the noise levels associated with the wide variety of types and numbers of equipment. Mobile construction equipment, such as dozers, scrapers, graders, etc., operate in a cyclical fashion in which a period of full power is followed by a period of reduced power. Stationary equipment can be subdivided into two groups. One group contains such items as pumps, generators, compressors, etc., that generally operate at a fixed power and produce a fairly constant sound level under normal operation. The other group contains impact equipment such as pile drivers, jackhammers, pavement breakers, etc.

The equipment operating at a specific site will depend upon which phase of the job is occurring at that time. For the construction of the project, the following five phases are anticipated:

- Ground clearing - Unwanted vegetation and ground cover will be removed in areas where specific construction activities are scheduled. These activities may include actual site and roadway preparation. Bulldozers, dump trucks, and front-end loaders are generally used to accomplish this phase.

- Earthwork - The existing topography will be altered during this phase as part of facilitating drainage, leveling, and providing adequate profile for new roadways or other development. Equipment generally involved in this phase includes bulldozers, scrapers, earthmovers, and backhoes.

- Roadway construction/upgrading - For new roadways, the actual road will be constructed. For existing roadways, the roads will be resurfaced. Pavers, dump trucks, graders, scrapers, vibrators, and rollers are generally utilized in this phase.

- Drilling/demolition - These activities will be required for construction of foundations for support facilities. Equipment generally used includes air compressors, dump trucks, front-end loaders, rock drills, and assorted hand tools.

- Erection - Actual erection of structures will primarily involve the use of cranes, air compressors, and hand tools.

Typical ranges of noise levels associated with the various phases of construction for specific types of structures are shown in Table 3.1-6. The ranges of noise levels for individual pieces of equipment that contribute part of these overall noise levels are summarized in Figure 3.1-1.

Properly maintained and muffled equipment will produce noise levels in the lower end of these ranges. The percent contribution to construction site noise of individual pieces of equipment is shown in Table 3.1-7.

3.2 Assumptions and Assumed Mitigations

3.2.1 Assumptions

The assumptions discussed below are general and relate to the assessment activity performed for each specific noise element. A presentation of the assumptions implicit in each of the simulation models or procedures presented in Section 3.1 is contained in Appendix D.

The vehicular noise assessment assumes that Cheyenne local roadways, exclusive of Interstates 25 and 80 which operated at posted limits, operate at a minimum of 30 miles per hour (mph) during the peak hour period. This speed limit is the lowest threshold for which STAMINA 2.0 can predict associated noise levels. It represents a conservative estimate for worst-case noise analysis since lower assumed speeds would result in correspondingly lower noise level predictions. For purposes of determining impacts of noise levels, the roadway right-of-way was assumed to define the beginning of the receptor (residential) property line.

For the analysis of construction noise, it was assumed that all construction equipment will be operated with noise attenuation devices (i.e., mufflers and baffles).

3.2.2 Assumed Mitigations

No assumed mitigations were included as part of this study assessment. (This is equivalent to performing a conservative impact analysis).

Table 3.1-6

TYPICAL RANGES OF NOISE LEVELS MEASURED AS L_{eq} AT CONSTRUCTION SITES WITH A 70 dB(A) AMBIENT NOISE LEVEL

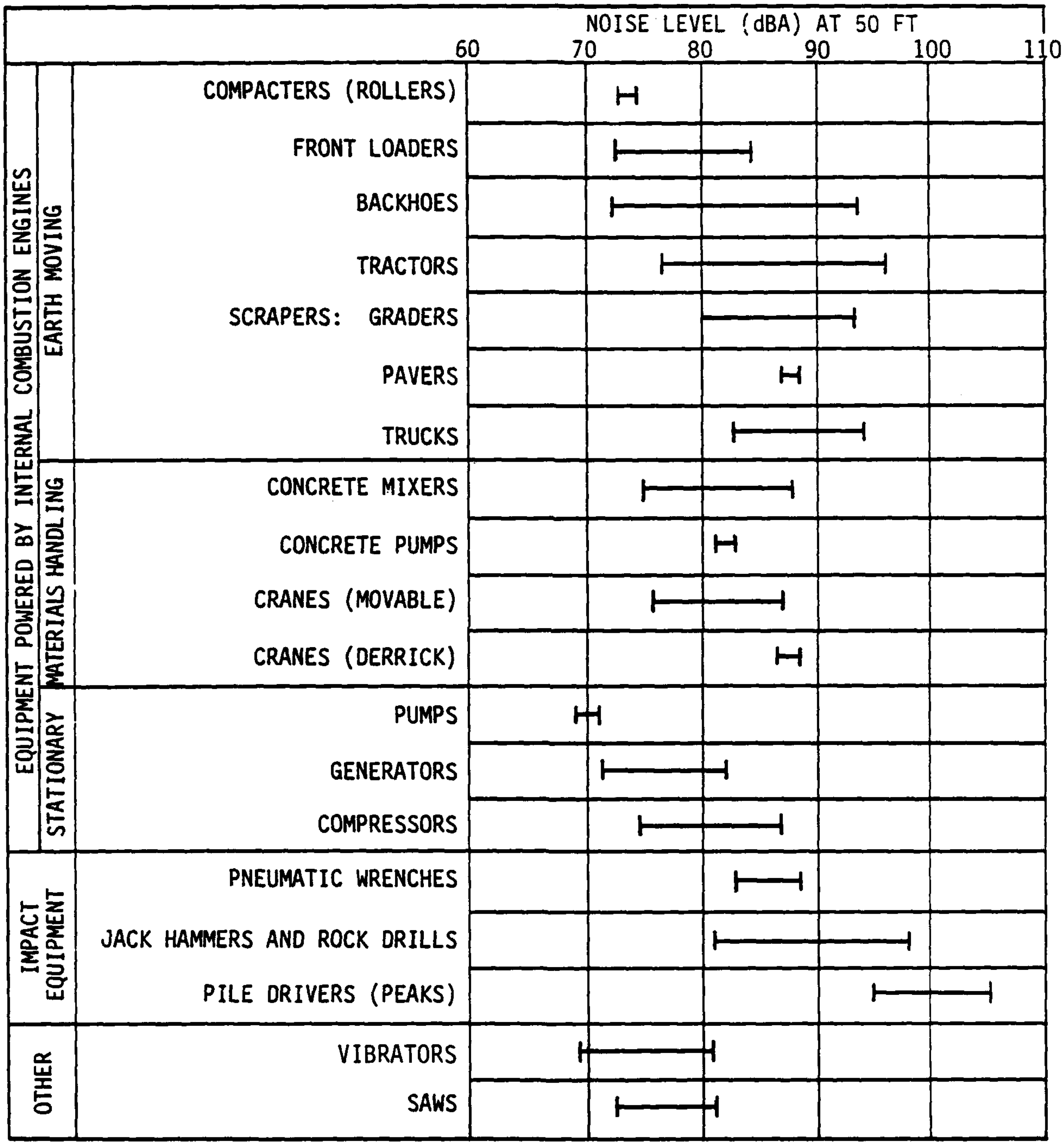
	Domestic Housing		Office Building, Hotel, Hospital, School, Public Works		Industrial, Parking Garage, Religious, Amusement & Recreations, Store, Service Station		Public Works, Roads & Highways, Sewers and Trenches	
	I	II	I	II	I	II	I	II
Ground Clearing	84 dB(A)	83 dB(A)	84 dB(A)	84 dB(A)	84 dB(A)	87 dB(A)	84 dB(A)	84 dB(A)
Excavation	88 dB(A)	76 dB(A)	89 dB(A)	79 dB(A)	89 dB(A)	74 dB(A)	89 dB(A)	79 dB(A)
Foundations	81 dB(A)	81 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	78 dB(A)	88 dB(A)	88 dB(A)
Erection	82 dB(A)	71 dB(A)	85 dB(A)	76 dB(A)	85 dB(A)	74 dB(A)	79 dB(A)	79 dB(A)
Finishing	88 dB(A)	74 dB(A)	89 dB(A)	76 dB(A)	89 dB(A)	75 dB(A)	84 dB(A)	84 dB(A)

Notes: I - All pertinent equipment present at site.

II - Minimum required equipment present at site.

Source: EPA 1971.

CONSTRUCTION EQUIPMENT NOISE RANGES



Note: Based on Limited Available Data Samples.

Source: EPA 1971

CONSTRUCTION EQUIPMENT NOISE RANGES **FIGURE NO. 3.1-1**

Table 3.1-7

CONTRIBUTION TO CONSTRUCTION SITE NOISE OF INDIVIDUAL PIECES OF EQUIPMENT ON FOUR TYPES OF SITES IN THE U.S.

	Contribution[1] to Construction Site Noise, Percent			
Construction Equipment	Residential	Public Works	Industrial	Nonresidential
Backhoe	5.6	2.2	7.1	3.5
Dozer	10.0	6.8	8.9	4.8
Grader	2.0	1.9	0.3	0.2
Loader	6.3	3.0	4.4	2.5
Paver	2.5	10.8	1.7	0.8
Roller	0.5	1.7	0.2	-
Scraper	3.1	4.8	1.7	1.5
Shovel	2.2	1.0	2.5	1.2
Truck	6.3	21.5	11.3	7.7
Concrete Mixer	28.1	10.0	8.9	6.1
Concrete Pump	-[a]	-	2.1	2.2
Crane Derrick	-	1.9	1.6	3.1
Crane Mobile	5.6	0.7	1.0	1.9
Air Compressor	4.6	6.1	10.0	16.9
Generator	1.8	2.5	1.1	2.5
Pump	1.3	2.7	-	3.5
Paving Hammer	0.8	8.5	5.1	2.5
Pile Driver	-	-	20.6	24.6
Pneumatic Tool	11.3	1.4	6.3	3.1
Rock Drill	2.2	13.8	5.1	4.8
Concrete Vibrator	4.4	-	0.6	0.4
Saw	-	0.2	0.9	3.1

Notes: 1 On an energy basis.

a A dash indicates the equipment is not primarily used at the type of site cited or the percent contribution is less than 0.1 percent.

Source: EPA 1971.

3.3 Level of Impact Definitions

This section presents a review of the federal, state, and local noise standards and regulations that serve as a basis for defining project-related impacts. In addition it presents the rationale for how these standards and regulations were applied to develop criteria for assessing the level of project impacts.

The standard unit for measuring noise is the decibel (dB), generally adjusted to the A-scale (dBA) which corresponds to the range of human hearing (EPA Office of Noise Abatement and Control 1974). A 3-dBA increase in noise level is typically the minimum noticeable, while a 10-dBA increase is perceived as a doubling of sound (Bolt, Beranek and Newman, Inc. 1973).

In the outdoor environment, sounds are usually not continuous. A common unit of measurement is the L_{eq}, which is the time-averaged sound energy. The L_{dn} is the day/night sound level. It is the energy-averaged equivalent level (L_{eq}) for a 24-hour period, with a 10 dBA penalty added for sounds occurring between 10:00 PM and 7:00 AM. The peak hour Leq is approximately equivalent to the Ldn, and both noise level measurements have been used for comparative purposes in this respect. The L_{10} noise level is the sound level exceeded 10 percent of the time and is typically used to represent peak noise levels.

Several federal agencies have promulgated noise standards based upon the specific noise level above which noise becomes intrusive. These levels are typically related to sensitivity of land use adjacent to the noise source. The U.S. Environmental Protection Agency (EPA), for example, has defined a noise "hot spot" as an L_{dn} equal to or greater than 75 dBA in residential areas or 65 dBA in noise-sensitive areas such as around nursing homes, hospitals, churches, and areas where windows are likely to be open (EPA Office of Noise Abatement and Control 1981).

For the purposes of this report, future vehicular noise levels have been determined for the Proposed Action and the No Action Alternative and compared conservatively to noise level standards developed by the FHWA (1982b). These FHWA standards are presented in Table 3.3-1 and reported in both L_{eq} and L_{10} noise levels.

Both air traffic noise and railroad noise have been evaluated for a noise level L_{dn} standard of 65. The FAA has developed recommendations for noise standards for airport operations. The standard is a noise level of 65 L_{dn} predicted at airport boundaries. No specific noise standards have been promulgated for railroad operation; however, the EPA L_{dn} standard of 65 is justified for such use as it was developed to minimize intrusive residential noise. As noted previously, the peak hour L_{eq} noise standard for vehicular noise is directly comparable to the L_{dn} noise standard used for air traffic and railroad noise.

A noise effect due to project-related increases in vehicular, air or railroad traffic, or construction activity (individually or in combination) will be classified as having a negligible, low, moderate, or high impact depending upon the magnitude and/or duration of that effect upon the existing ambient noise environment, relative to the local population and/or land use. Noise impacts are confined to the local vicinity of the noise sources.

Table 3.3-1

DESIGN NOISE LEVEL/ACTIVITY RELATIONSHIPS

Activity Category	Design Noise Levels[1] dBA L_{eq} (hr)	L_{10} (hr)	Description of Activity Category
A[2]	57 (Exterior)	60 (Exterior)	Tracts of land where serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of these qualities is essential if the area is to continue to serve its intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, open spaces or historic districts which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B[2]	67 (Exterior)	70 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, and parks which are not included in Category A; and residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.
C	72 (Exterior)	75 (Exterior)	Developed lands, properties or activities not included in Categories A or B above.
D	-	-	For requirements on undeveloped lands, see paragraphs 11a and c of Federal Aid Highway Program Manual, Volume 7, Chapter 7, Section 3.
E	52 (Interior)	55 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.

Notes: 1 Either L_{10} or L_{eq} (but not both) design noise levels may be used on a project.

2 Parks in Categories A and B include all such lands (public or private) which are actually used as parks, as well as those public lands officially set aside or designated by a governmental agency by the date of public knowledge of the proposed highway project.

Source: Federal Highway Administration, Policy and Procedure Memorandum 90-2 1982b.

The following levels of impact will be used in the analysis:

- Negligible Impact - Predicted noise impacts will not exceed ambient noise levels by more than 2.9 dBA. The increase is perceived as barely noticeable.
- Low Impact - Predicted noise impacts will exceed ambient noise levels by 3 to 4.9 dBA. The increase is perceived as generally noticeable.
- Moderate Impact - Predicted noise impacts will exceed ambient noise levels by 5 to 9.9 dBA. The increase is perceived as clearly noticeable.
- High Impact - Predicted noise impacts will exceed ambient noise levels by 10 dBA or more. The increase is perceived as doubling of the noise level.

These impact levels are based upon the fact that noise level changes of 3 dBA or less are perceived as negligible by most people, while an increase of 10 dBA is perceived as a doubling in sound (Bolt, Beranek and Newman, Inc. 1973).

3.4 Significance Determination

For the noise level analysis, an increase in noise will be considered significant if any of the following conditions occur for an extended period of time:

- An increase in noise levels of 10 dBA if the existing noise levels are below 55 dBA (creates a potential significant nuisance effect);
- An increase in noise levels that causes an exceedance of noise level standards if the existing noise levels are between 55 and 60 dBA (violates existing regulatory requirement); or
- An increase in noise levels of 5 dBA if the existing noise levels are above 60 dBA (violates or worsens an existing regulatory requirement).

For vehicular traffic, an L_{eq} noise level of 65 (FHWA 1982b) will be used. For railroad and aircraft operations, an L_{dn} standard (FAA 1983 and EPA Office of Noise Abatement and Control 1981) of 65 will be used. For construction activity, applicable federal, state, and/or local standards, criteria, or ordinances will be applied. The L_{eq} and L_{dn} measures are expressed on the dBA sound level scale. For purposes of comparing noise level indices, the L_{eq} (for the peak traffic period) is approximately equivalent to the L_{dn}.

3.5 Environmental Consequences of the Proposed Action and No Action Alternative

The following section presents the analytic results of the noise impact analysis for the Proposed Action, project element alternatives and the No Action Alternative for the short term, 1985 (peak year of construction), and the long term, 1990 (beginning year of operations).

3.5.1 Vehicular Noise

The assessment of vehicle-generated noise impacts in the project area was undertaken using the FHWA's STAMINA 2.0 noise prediction model. The assessment was performed for those roadway segments that were anticipated to convey increased traffic volumes as a result of implementing the project. The selection of these roadways was coordinated with the transportation task group and reflects the concerns voiced by state and local agencies and the public. The roadway segments assessed are provided in Table 3.5-1.

Table 3.5-1

ROADWAY SEGMENTS ASSESSED FOR NOISE-LEVEL IMPACTS

Project Area Locale	Roadway Segment	Description
Cheyenne, Wyoming	Interstate 25	Four Mile Road to U.S. 30
	Prairie Avenue	Yellowstone Road to Dell Range Boulevard
	Dell Range Boulevard	Prairie Avenue to Powder House Road
	Central Avenue	Interstate 25 to Warren Avenue
	Pershing Boulevard	Carey Avenue to U.S. 30
	College Drive	Parsley Boulevard to Walterscheid Boulevard
	Windmill Road	Dell Range Boulevard to Pershing Boulevard
	Ridge Road	Four Mile Road to Dell Range Boulevard
	Lincolnway	Pershing Boulevard to Morrie Avenue
	Parsley Boulevard	Interstate 80 to Ames Avenue
	Missile Drive	Interstate 25 to 20th Street
	Evans Avenue	Eighth Avenue to Pershing Boulevard
	Ames Avenue	Parsley Boulevard to 20th Street
	20th Street	Logan Avenue to Ames Avenue
Kimball, Nebraska	U.S. Route 30	
	Route 71	
Wheatland, Wyoming	16th Street	
	South Street	

Other roadways throughout the project area, notably in Kimball, Gering, and Scottsbluff, Nebraska, and Torrington, Wyoming, were preliminarily screened as to their potential for having project-related impacts. An increase in vehicular volumes of approximately 26 percent is generally necessary to result in a single decibel increase in noise levels. Other factors that influence this percentage are the number of heavy trucks and steepness of roadway grades encountered. Based upon review of vehicular volume increases, U.S. 30 and Route 71 in Kimball, Nebraska, and 16th and South streets in Wheatland, Wyoming, were evaluated as representing worst-case analysis outside the Cheyenne area.

It should be noted that peak construction year noise impact analyses were performed for 1985 except in Kimball, Nebraska and Wheatland, Wyoming, which were done for 1986, the peak construction year for those locations.

3.5.1.1 Baseline Future - No Action Alternative

The results of the STAMINA 2.0 noise analysis for the No Action Alternative are shown in Table 3.5-2. This table presents L_{eq} noise levels predicted at the roadway rights-of-way and beyond in 100-foot increments. This form of presentation is useful in examining the sound level attenuation with distance. All levels are predicted to be below 65.0 dBA within 200 feet of the right-of-way except for Interstate 25 (between Central Avenue and Pershing Boulevard), in 1990. As noted previously, the roadway right-of-way is assumed to represent the residential property line.

In 1985 the 65-L_{eq} noise level is predicted to be exceeded at the right-of-way boundary along segments of Interstate 25, Prairie Avenue, Central Avenue, Pershing Boulevard, College Drive, Windmill Road, and Evans Avenue in Cheyenne; U.S. 30 in Kimball; and 16th and South streets in Wheatland. In 1990, the 65-L_{eq} noise level will be exceeded along all of the above roadway segments as well as additional segments along Dell Range Boulevard, Ridge Road, and Lincolnway in Cheyenne; and Route 71 in Kimball.

The maximum L_{eq} noise levels predicted in 1985 and 1990 were 68.9 and 70.5, respectively, in Cheyenne along Interstate 25; and 71.0 and 71.4, respectively, in Wheatland along South Street. The analysis also indicates that approximately 37 dwelling units with an estimated population of 93 people will fall within the calculated 65-L_{eq} noise contour which extends beyond the right-of-way along Interstate 25 in Cheyenne in 1985 and 1990. In Kimball, approximately 36 dwelling units with an estimated population of 90 people will lie within the 65-L_{eq} contour in 1985 and 1990. In Wheatland, approximately 136 dwelling units with an estimated population of 340 people will lie within the 65-L_{eq} contour in 1985 and 1990. The distance of the 65-L_{eq} noise contour from the respective roadway right-of-way for the 1985 and 1990 No Action Alternative is provided in Table 3.5-3.

Graphic representations of the roadways analyzed (with demarcation of the 65-L_{eq} noise level contour) are provided in Appendix C.

Table 3.5-2

PREDICTED NOISE LEVELS AT SELECTED RECEPTORS FOR 1985 AND 1990

Roadway Segments	Year	Project Option	Right-of-Way (L_{eq})	Difference Between Proposed Action and No Action	Distance From Right-of-Way Line: 100 Ft (L_{eq})	Distance From Right-of-Way Line: 200 Ft (L_{eq})
Cheyenne, Wyoming						
Interstate 25 (Four Mile Road to Central Avenue)	1985	No Action	66.6		63.4	61.2
	1985	Proposed Action	67.1	0.5	63.9	61.7
	1990	No Action/ Proposed Action	68.0		64.7	62.6
Interstate 25 (Central Avenue to Pershing Boulevard)	1985	No Action	68.9		65.7	63.6
	1985	Proposed Action	69.2	0.3	66.1	64.0
	1990	No Action/ Proposed Action	70.5		67.3	65.1
Interstate 25 (Pershing Boulevard to Missile Drive)	1985	No Action	68.9		65.7	63.6
	1985	Proposed Action	69.1	0.2	66.1	63.9
	1990	No Action/ Proposed Action	70.2		67.0	64.8
Interstate 25 (Missile Drive to U.S. 30)	1985	No Action	67.7		64.5	62.4
	1985	Proposed Action	68.1	0.4	64.9	62.8
	1990	No Action/ Proposed Action	69.3		66.1	63.9
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	1985	No Action	66.8		58.3	54.7
	1985	Proposed Action	67.3	0.5	58.9	55.2
	1990	No Action/ Proposed Action	67.7		59.3	55.6
Dell Range Boulevard (Prairie Avenue to Powder House Road)	1985	No Action	63.5		57.6	54.7
	1985	Proposed Action	65.5	2.0	58.4	55.1
	1990	No Action/ Proposed Action	65.9		58.8	55.5

Table 3.5-2 Continued, Page 2 of 5
PREDICTED NOISE LEVELS AT SELECTED RECEPTORS
FOR 1985 AND 1990

Roadway Segments	Year	Project Option	Right-of-Way (L_{eq})	Difference Between Proposed Action and No Action	Distance From Right-of-Way Line: 100 Ft (L_{eq})	200 Ft (L_{eq})
Central Avenue (I-25 to Yellowstone Road)	1985	No Action	65.6	0.9	58.3	54.8
	1985	Proposed Action	66.5		59.2	55.7
	1990	No Action/ Proposed Action	66.5		59.2	55.7
Central Avenue (Yellowstone Road to Warren Avenue)	1985	No Action	67.1	0.4	59.8	56.3
	1985	Proposed Action	67.5		60.2	56.7
	1990	No Action/ Proposed Action	67.6		60.3	56.8
Pershing Boulevard (Carey Avenue to Central Avenue)	1985	No Action	64.0	0.6	56.7	53.2
	1985	Proposed Action	64.6		57.3	53.8
	1990	No Action/ Proposed Action	64.9		57.6	54.1
Pershing Boulevard (Central Avenue to Warren Avenue)	1985	No Action	64.8	0.5	57.5	54.0
	1985	Proposed Action	65.3		58.0	54.5
	1990	No Action/ Proposed Action	65.9		58.6	55.1
Pershing Boulevard (Evans Avenue to Morrie Avenue)	1985	No Action	67.0	0.4	59.8	56.3
	1985	Proposed Action	67.4		60.2	56.7
	1990	No Action/ Proposed Action	67.9		60.7	57.2
Pershing Boulevard (Morrie Avenue to Logan Avenue)	1985	No Action	66.7	0.6	59.5	56.0
	1985	Proposed Action	67.3		60.0	56.5
	1990	No Action/ Proposed Action	67.7		60.5	57.0

Table 3.5-2 Continued, Page 3 of 5
PREDICTED NOISE LEVELS AT SELECTED RECEPTORS
FOR 1985 AND 1990

Roadway Segments	Year	Project Option	Right-of-Way (L_{eq})	Difference Between Proposed Action and No Action	Distance From Right-of-Way Line: 100 Ft (L_{eq})	Distance From Right-of-Way Line: 200 Ft (L_{eq})
Pershing Boulevard (Logan Avenue to Converse Avenue)	1985	No Action	65.6		58.4	54.9
	1985	Proposed Action	66.7	1.1	59.5	56.0
	1990	No Action/ Proposed Action	66.9		59.7	56.2
Pershing Boulevard (Converse Avenue to Windmill Road)	1985	No Action	66.2		59.0	55.5
	1985	Proposed Action	66.9	0.7	59.6	56.1
	1990	No Action/ Proposed Action	66.4		59.1	55.6
Pershing Boulevard (Ridge Road to U.S. 30)	1985	No Action	62.9		55.7	52.2
	1985	Proposed Action	63.6	0.7	56.4	52.9
	1990	No Action/ Proposed Action	65.2		58.0	54.5
College Drive (Parsley Boulevard to Walterscheid Boulevard)	1985	No Action	65.1		57.9	54.4
	1985	Proposed Action	65.8	0.7	58.5	55.0
	1990	No Action/ Proposed Action	66.8		59.6	56.1
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	1985	No Action	65.8		58.6	55.1
	1985	Proposed Action	66.5	1.3	59.3	55.8
	1990	No Action/ Proposed Action	66.1		58.8	55.3
Ridge Road (Four Mile Road to Dell Range Boulevard)	1985	No Action	64.8		57.6	54.1
	1985	Proposed Action	65.1	0.3	57.9	54.4
	1990	No Action/ Proposed Action	65.5		58.3	54.8

Table 3.5-2 Continued, Page 4 of 5
PREDICTED NOISE LEVELS AT SELECTED RECEPTORS
FOR 1985 AND 1990

Roadway Segments	Year	Project Option	Right-of-Way (L_{eq})	Difference Between Proposed Action and No Action	Distance From Right-of-Way Line: 100 Ft (L_{eq})	Distance From Right-of-Way Line: 200 Ft (L_{eq})
Lincolnway (Pershing Boulevard to Ridge Road)	1985	No Action	60.0		57.0	54.9
	1985	Proposed Action	60.6	0.6	57.6	55.4
	1990	No Action/ Proposed Action	61.5		58.5	56.4
Lincolnway (Logan Avenue to Morrie Avenue)	1985	No Action	64.4		61.4	59.3
	1985	Proposed Action	64.9	0.5	61.9	59.7
	1990	No Action/ Proposed Action	65.4		62.4	60.2
Parsley Boulevard (I-80 to Ames Avenue)	1985	No Action	60.7		53.4	49.9
	1985	Proposed Action	61.6	0.9	54.4	50.9
	1990	No Action/ Proposed Action	61.0		53.8	50.3
Missile Drive (Interstate 25 to 20th Street)	1985	No Action	62.1		55.6	52.5
	1985	Proposed Action	63.3	1.2	56.8	53.7
	1990	No Action/ Proposed Action	63.1		56.6	53.5
Evans Avenue (8th Avenue to Pershing Boulevard)	1985	No Action	65.1		57.0	53.7
	1985	Proposed Action	65.5	0.4	57.4	54.0
	1990	No Action/ Proposed Action	66.0		57.9	54.5
Ames Avenue (Parsley Boulevard to 20th Street)	1985	No Action	64.5		57.3	53.8
	1985	Proposed Action	65.0	0.5	57.8	54.3
	1990	No Action/ Proposed Action	64.7		57.5	54.0

Table 3.5-2 Continued, Page 5 of 5
PREDICTED NOISE LEVELS AT SELECTED RECEPTORS
FOR 1985 AND 1990

Roadway Segments	Year	Project Option	Right-of-Way (L_{eq})	Difference Between Proposed Action and No Action	Distance From Right-of-Way Line 100 Ft (L_{eq})	200 Ft (L_{eq})
20th Street (Logan Avenue to Morrie Avenue)	1985	No Action	63.7		56.5	53.0
	1985	Proposed Action	64.5	0.8	57.3	53.8
	1990	No Action/ Proposed Action	64.1		56.9	53.4
20th Street (Snyder Avenue to Ames Avenue)	1985	No Action	61.0		53.7	50.2
	1985	Proposed Action	61.2	0.2	53.9	50.4
	1990	No Action/ Proposed Action	62.7		55.5	52.0
Kimball, Nebraska						
U.S. 30	1985	No Action	66.9		59.7	56.2
	1986	Proposed Action	68.0	1.1	60.7	57.2
	1990	No Action/ Proposed Action	67.4		60.1	56.6
Route 71	1985	No Action	64.7		57.4	53.9
	1986	Proposed Action	66.3	1.6	59.0	55.5
	1990	No Action/ Proposed Action	65.1		57.8	54.3
Wheatland, Wyoming						
16th Street	1985	No Action	69.7		62.4	58.9
	1986	Proposed Action	70.4	0.7	63.1	59.6
	1990	No Action/ Proposed Action	70.0		62.7	59.2
South Street	1985	No Action	71.0		63.7	60.2
	1986	Proposed Action	71.6	0.6	64.3	60.8
	1990	No Action/ Proposed Action	71.4		64.0	60.6

Table 3.5-3

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE

RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION
(1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Cheyenne, Wyoming					
Interstate 25 (Four Mile Road to Central Avenue)	1985	No Action	45	0	0
	1985	Proposed Action	60	27	68
	1990	No Action/ Proposed Action	90	27	68
Interstate 25 (Central Avenue to Pershing Boulevard)	1985	No Action	130	37	93
	1985	Proposed Action	145	37	93
	1990	No Action/ Proposed Action	200	37	93
Interstate 25 (Pershing Boulevard to Missile Drive)	1985	No Action	130	0	0
	1985	Proposed Action	145	0	0
	1990	No Action/ Proposed Action	200	0	0
Interstate 25 (Missile Drive to U.S. 30)	1985	No Action	80	0	0
	1985	Proposed Action	100	0	0
	1990	No Action/ Proposed Action	140	0	0
Prairie Avenue (Yellowstone Road to Dell Range Boulevard)	1985	No Action	5	0	0
	1985	Proposed Action	10	0	0
	1990	No Action/ Proposed Action	15	0	0

Table 3.5-3 Continued, Page 2 of 6

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION (1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Dell Range Boulevard (Prairie Avenue to Powder House Road)	1985	No Action	a	0	0
	1985	Proposed Action	5	0	0
	1990	No Action/ Proposed Action	10	0	0
Central Avenue (I-25 to Yellowstone Road)	1985	No Action	5	0	0
	1985	Proposed Action	10	0	0
	1990	No Action/ Proposed Action	10	0	0
Central Avenue (Yellowstone Road to Warren Avenue)	1985	No Action	20	0	0
	1985	Proposed Action	20	0	0
	1990	No Action/ Proposed Action	25	0	0
Pershing Boulevard (Carey Avenue to Central Avenue)	1985	No Action	a	0	0
	1985	Proposed Action	a	0	0
	1990	No Action/ Proposed Action	a	0	0
Pershing Boulevard (Central Avenue to Warren Avenue)	1985	No Action	a	0	0
	1985	Proposed Action	0	0	0
	1990	No Action/ Proposed Action	5	0	0
Pershing Boulevard (Evans Avenue to Morrie Avenue)	1985	No Action	15	0	0
	1985	Proposed Action	20	0	0
	1990	No Action/ Proposed Action	25	0	0

Table 3.5-3 Continued, Page 3 of 6

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION (1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Pershing Boulevard (Morrie Avenue to Logan Avenue)	1985	No Action	15	0	0
	1985	Proposed Action	20	5	13
	1990	No Action/ Proposed Action	25	5	13
Pershing Boulevard (Logan Avenue to Converse Avenue)	1985	No Action	5	0	0
	1985	Proposed Action	15	0	0
	1990	No Action/ Proposed Action	15	0	0
Pershing Boulevard (Converse Avenue to Windmill Road)	1985	No Action	10	0	0
	1985	Proposed Action	15	0	0
	1990	No Action/ Proposed Action	10	0	0
Pershing Boulevard (Ridge Road to U.S. 30)	1985	No Action	a	0	0
	1985	Proposed Action	a	0	0
	1990	No Action/ Proposed Action	0	0	0
College Drive (Parsley Boulevard to Walterscheid Boulevard)	1985	No Action	0	0	0
	1985	Proposed Action	5	0	0
	1990	No Action/ Proposed Action	15	0	0
Windmill Road (Dell Range Boulevard to Pershing Boulevard)	1985	No Action	5	0	0
	1985	Proposed Action	10	0	0
	1990	No Action/ Proposed Action	10	0	0

Table 3.5-3 Continued, Page 4 of 6

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE
RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION
(1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Ridge Road	1985	No Action	0	0	0
(Four Mile Road to	1985	Proposed Action	5	0	0
Dell Range Boulevard)	1990	No Action/ Proposed Action	5	0	0
Lincolnway	1985	No Action	a	0	0
(Pershing Boulevard to	1985	Proposed Action	a	0	0
Ridge Road)	1990	No Action/ Proposed Action	a	0	0
Lincolnway	1985	No Action	a	0	0
(Logan Avenue to	1985	Proposed Action	a	0	0
Morrie Avenue)	1990	No Action/ Proposed Action	10	0	0
Parsley Boulevard	1985	No Action	a	0	0
(I-80 to Ames Avenue)	1985	Proposed Action	a	0	0
	1990	No Action/ Proposed Action	a	0	0
Missile Drive	1985	No Action	a	0	0
(Interstate 25 to	1985	Proposed Action	a	0	0
20th Street)	1990	No Action/ Proposed Action	a	0	0
Evans Avenue	1985	No Action	0	0	0
(8th Avenue to	1985	Proposed Action	5	0	0
Pershing Boulevard)	1990	No Action/ Proposed Action	5	0	0

Table 3.5-3 Continued, Page 5 of 6

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION (1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Ames Avenue (Parsley Boulevard to 20th Street)	1985	No Action	a	0	0
	1985	Proposed Action	0	0	0
	1990	No Action/ Proposed Action	a	0	0
20th Street (Logan Avenue to Morrie Avenue)	1985	No Action	a	0	0
	1985	Proposed Action	a	0	0
	1990	No Action/ Proposed Action	a	0	0
20th Street (Snyder Avenue to Ames Avenue)	1985	No Action	a	0	0
	1985	Proposed Action	a	0	0
	1990	No Action/ Proposed Action	a	0	0
Kimball, Nebraska					
U.S. 30	1985	No Action	15	0	0
	1986	Proposed Action	25	0	0
	1990	No Action/ Proposed Action	30	0	0
Route 71	1985	No Action	a	0	0
	1986	Proposed Action	10	0	0
	1990	No Action/ Proposed Action	0	0	0

Table 3.5-3 Continued, Page 6 of 6

DISTANCE OF THE 65-L_{eq} NOISE LEVEL CONTOURS FROM THE RIGHT-OF-WAY FOR THE NO ACTION ALTERNATIVE AND PROPOSED ACTION (1985 AND 1990)

Roadway Segments	Year	Project Option	Distance From Right-of-Way[1] (feet)	Estimated Number of Dwelling Units Impacted	Estimated Population Impacted
Wheatland, Wyoming					
16th Street	1985	No Action	90	36	90
	1986	Proposed Action	100	36	90
	1990	No Action/ Proposed Action	90	36	90
South Street	1985	No Action	110	100	250
	1986	Proposed Action	130	108	270
	1990	No Action/ Proposed Action	115	100	250

Notes: 1 Distances rounded to the nearest 5 feet.

a Designates the 65-L_{eq} contour is contained within the right-of-way.

3.5.1.2 Proposed Action

The results of the STAMINA 2.0 noise analysis for the project are also shown in Table 3.5-2. For 1985 (short term), the project is predicted to result in a negligible, not significant impact of vehicular noise. The maximum predicted increase in noise levels is along Dell Range Boulevard between Prairie Avenue and Powder House Road with an increase in the L_{eq} noise level of 2.0 dBA. The predicted long-term (1990) noise levels for the project are identical to those for the No Action Alternative. The distance of the project-related 65-L_{eq} contour from the respective right-of-way for 1985 and 1990 is provided in Table 3.5-3. Graphic representations of the roadways analyzed (with demarcation of the 65-L_{eq} noise level contour) are provided in Appendix C.

In 1985 in Cheyenne, the 65-L_{eq} noise level contour associated with the project will encompass an additional 27 dwelling units along Interstate 25 (between Four Mile Road and Central Avenue) with an estimated population of 68 people; and 5 dwelling units along Pershing Boulevard (between Morrie Avenue and Logan Avenue) with an estimated population of 13 people when compared to the No Action Alternative. In Wheatland, the project will result in an additional 8 dwelling units along South Street with an estimated population of 20 people within the 65-L_{eq} contour when compared to the No Action Alternative. No cumulative noise effects between roadways and other noise sources (i.e., airports or railroad) are predicted. In addition, no effects on land use adjacent to the evaluated roadways are anticipated.

The use of dispatch stations will result in increased construction personnel-related vehicular trips to and from the station site along affected roadways. Noise increases relating to the use of these stations will, however, be negligible and not significant.

Because of the minimal increases in traffic volumes associated with project alternatives, the impacts of vehicular noise with respect to construction of any of the alternative road access routes at F.E. Warren AFB, dispatch station alternatives, or cable path alternatives are predicted to be negligible and not significant.

3.5.2 Air Traffic Noise

The FAA airport noise-contouring procedure was used for evaluation of L_{dn} noise levels associated with the Cheyenne Airport in 1985 and 1990 for the Proposed Action and the No Action Alternative. Predictions of future airport operations were developed by the transportation task group.

3.5.2.1 Baseline Future - No Action Alternative

The FAA procedure bases determination of noise contour configuration on annual air traffic operations. L_{dn} noise level contours for 1985 and 1990 were developed using flight operations figures.

Anticipated growth of jet aircraft operations at Cheyenne Airport was projected to be approximately 7 percent per year. Since jet aircraft produce the greatest noise at the airport and, hence, are the controlling factor in the size and configuration of the noise contours, the increase in distribution of quieter turbofan jets would result in a decrease of overall noise levels. The 65-L_{dn} noise contour for 1990 covers a smaller area. However, for a conservative analysis, it is assumed that the 1990 noise contour is the same as that for 1985. This noise contour, representing the 65-L_{dn} noise level, is presented in Figure 3.5-1.

The analysis indicates that about 141 dwelling units (south, east, and northwest of the airport) with an estimated population of 353 people fall within the calculated 65-L_{dn} noise level contour which extends beyond the airport boundary. The slightly smaller area covered by the 65-L_{dn} contour, when compared to existing conditions, results from a projected decrease in noisier aircraft, i.e., turbojets, among business jet operations.

3.5.2.2 Proposed Action

The short-term (1985) 65-L_{dn} noise level contour for the project is also shown in Figure 3.5-1. It is identical to the contour for the 1985 No Action Alternative because the total number of project-generated aircraft operations and existing baseline operations falls within the same range of operations that is representative of the No Action Alternative. The long-term (1990) project-related 65-L_{dn} noise contour is the same as the No Action Alternative contour, as shown in Figure 3.5-1, because no project-related air traffic activity is projected for 1990. No effect on land use adjacent to the airport is anticipated. No cumulative noise effects between the airport and area roadways or the railroad station are predicted. The impact is therefore negligible and not significant.

Because of the minimal increases in airport operations associated with project alternatives, the impact of air traffic noise with respect to construction of any of the alternative road access routes at F.E. Warren AFB, dispatch station alternatives, or cable path alternatives is predicted to be negligible and not significant.

3.5.3 Railroad Noise

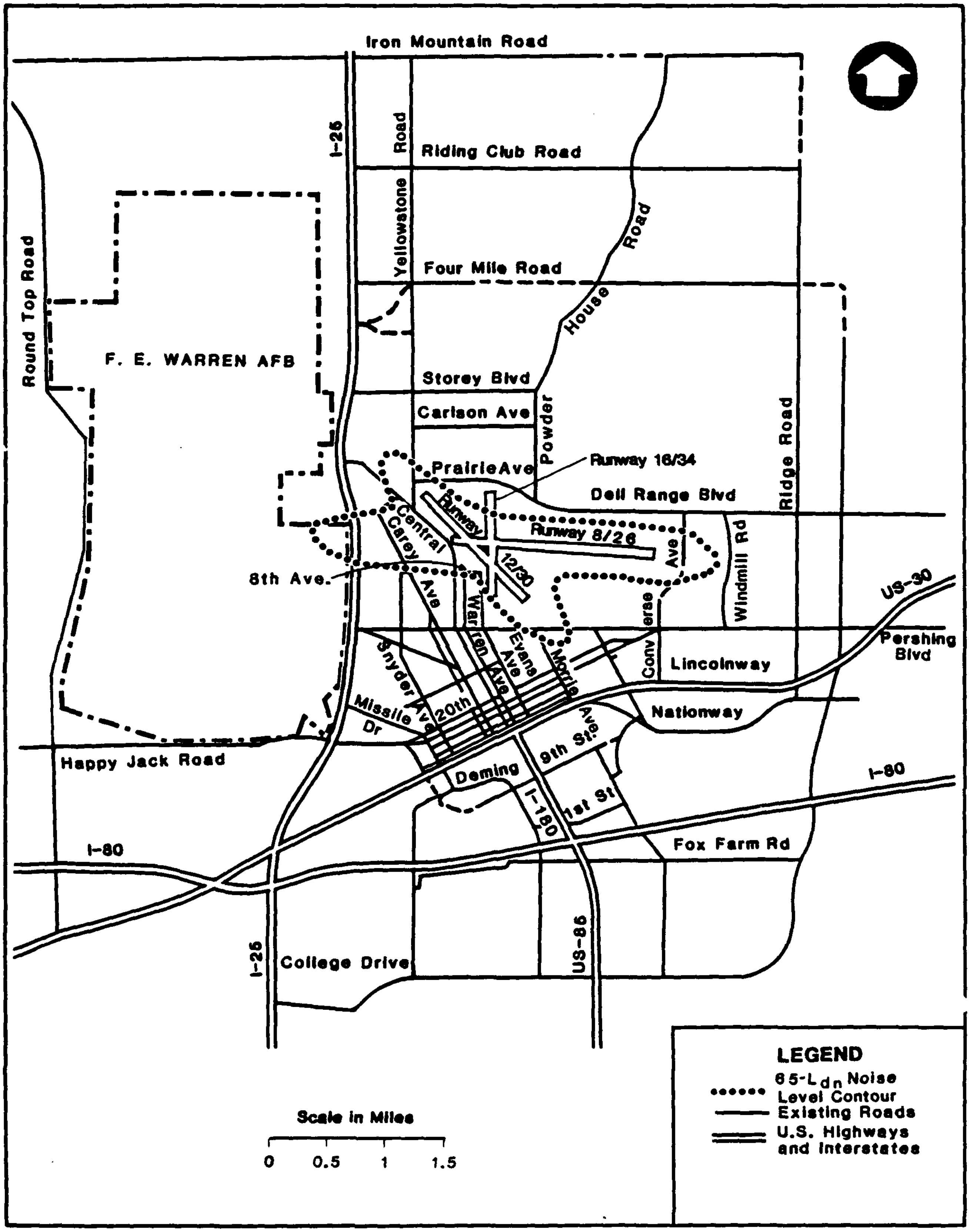
Based upon coordinated efforts with the transportation task group and conversations with the Cheyenne Railroad Station Master, projected operations increases in 1985 and 1990 are determined to be minimal. Further, there are minimal projected increases in railroad operations resulting from project implementation.

3.5.3.1 Baseline Future - No Action Alternative

The L_{dn} noise level contours for rail operations in 1985 and 1990 are identical to those projected for the existing conditions due to minimal growth in railroad activity (Figure 2.6-2). A total of 61 dwelling units (approximately 153 people) are predicted to fall within the 65-L_{dn} noise level contour which extends beyond the railroad boundary.

3.5.3.2 Proposed Action

The L_{dn} railroad noise level contours for the short term (1985) and long term (1990) are identical to those for 1983 existing conditions. Impacts are therefore predicted to be negligible and not significant. No cumulative noise



1985 AND 1990 CHEYENNE AIRPORT 65-L_{dn} NOISE LEVEL CONTOUR NO ACTION ALTERNATIVE AND THE PROPOSED ACTION

FIGURE NO. 3.5-1

impacts between the railroad and area roadways or airport operations are predicted.

Because of the minimal increases in railroad operations associated with project alternatives, the impact of railroad noise with respect to construction of any of the alternative road access routes at F.E. Warren AFB, dispatch station alternatives, or cable path alternatives is predicted to be negligible and not significant.

3.5.4 Construction Noise

3.5.4.1 Baseline Future - No Action Alternative

The typical ranges of noise levels from general construction activities or construction equipment are not expected to differ from those of existing conditions.

3.5.4.2 Proposed Action

Noise level increases due to construction are expected to occur within close proximity to project activities. Predicting construction noise for a specific project is difficult because of the variability of several factors which are critical in estimating construction-related noise but which often cannot be precisely known in advance of the actual work. These factors include the specific types of equipment on the job, the construction methods, and the scheduling of work. These details of the job are not generally specified in the contract documents but are left up to the contractor, thereby giving the contractor flexibility in utilizing equipment and personnel. To some extent, however, general conclusions can be made based on the types of construction work anticipated and the similarities of equipment and their associated ranges of noise levels.

The various activities that will take place include:

- Construction of structures, facilities, and a roadway at F.E. Warren AFB;
- Grading and modifications at LF silos;
- Widening and improving Deployment Area (DA) roadways; and
- Construction of project-induced housing (permanent and mobile homes) in Cheyenne.

Construction activity on F.E. Warren AFB is not anticipated to affect offbase residential land uses since such noise levels from point sources attenuate quickly with distance and the nearest residential dwelling is approximately 2,000 feet from any continuous construction noise source on the base.

With respect to grading and modifications at the LFs, the L_{eq} noise levels could be approximately 85.0 at 50 feet, assuming bulldozer and dump truck activity. This level will be expected to attenuate to 61.0 at about 800 feet. This activity will be of short duration.

Current projections indicate that approximately 642 miles of roadway may be upgraded to meet necessary specifications for access to the DA. Roadway construction activities are presently encompassed by resurfacing Option A, which consists of combining part asphalt and part gravel upgrade for existing gravel Defense Access Roads (DARs), and resurfacing Option B, which consists of paving all gravel DARs. In addition, where existing bridges pose height or weight restrictions to movement of LF or construction equipment, raising of bridge heights or lowering of pavement profiles may occur. Noise increases from such construction activities, which primarily involve equipment such as scrapers, graders, rollers, dump trucks and, for bridge work, cranes or derricks, will be of short duration at any given location. No difference in temporary noise increases is anticipated between resurfacing Options A and B. At sites where paving will occur, the use of a mobile asphalt batching plant may also result in temporary, short-duration noise increases.

The project will result in induced housing construction in Cheyenne and other locations in the project area. The peak net housing demand for Cheyenne was predicted to occur in 1986 and indicated the need for 93 single-family, 80 mobile and 6 multifamily dwelling units. The highest net housing demand outside of Cheyenne was predicted for 1988 in Pine Bluffs and will require 11 mobile and 14 multifamily dwelling units. The maximum total acreage assumed to be used at any 1 location was for 48 mobile homes (Cheyenne neighborhood number 27). Mobile home site preparation will require grading, provision for utilities, and construction of foundation pads. Of the activities, grading and excavation will result in an approximate 83.0 L_{eq} noise level at 50 feet which will attenuate to a L_{eq} of 65.0 at 400 feet. Single-family and multifamily home construction will result in L_{eq} noise levels of approximately 88.0 at 50 feet which will attenuate to 64.0 at 800 feet. The site preparation phase of these construction activities will be of short duration.

The project is predicted to result in short-term, negligible, and not significant impacts from construction noise. Long-term impacts will also be negligible and not significant because construction noise will cease when the construction activities end.

Because of the short duration of construction activity at any given location, the impacts of construction noise with respect to any of the alternative road access routes at F.E. Warren AFB, dispatch station alternatives, or cable path alternatives are predicted to be negligible and not significant.

3.6 Summary of Impacts

3.6.1 Impact Matrix

The noise impact matrix presents results of the analyses performed in this study including a summary of the levels of impact and significance determination for each element (Figure 3.6-1).

Negligible, short-term, not significant local impacts are predicted for vehicular traffic noise. The impact of increased air traffic due to project activities is determined to be negligible and not significant. Impact from increased railroad activity is determined to be negligible and not significant. Noise impacts from construction activities are also determined

LEGEND		ADVERSE IMPACTS	SIGNIFICANT ADVERSE IMPACTS
LEVEL OF IMPACT*	LOW	○	●
	MODERATE	○	●
	HIGH	○	●
POTENTIAL BENEFICIAL EFFECTS			
* MEASURE OF THE AMOUNT OF ENVIRONMENTAL CHANGE			

	PROJECT IMPACTS					
	SHORT TERM			LONG TERM		
	SITE	LOCAL	REGIONAL	SITE	LOCAL	REGIONAL
NOISE						
Vehicular Noise						
Air Traffic Noise						
Railroad Noise						
Construction Noise						

NOISE SUMMARY IMPACT MATRIX FIGURE NO. 3.6-1 to be negligible and not significant. All long-term impacts are determined to be negligible and not significant.

All the alternative road access routes at F.E. Warren AFB, dispatch station alternatives, and cable path alternatives are predicted to result in negligible, not significant impacts.

3.6.2 Aggregation of Elements, Impacts, and Significance

The aggregated rating of noise for the project results in negligible, short and long-term, not significant, local impacts (Figure 3.6-1).

Determination of the overall rating for noise involves aggregation of the impact ratings for the elements (component sources) of noise. The noise sources are evaluated as described in Section 3.5 and then aggregated to the resource level by giving an equal weighting factor to the impacts. Ambient noise level standards and/or guidelines have been established by various governmental agencies. These standards and/or guidelines set noise level limits, the exceedance of which may require mitigation to acceptable levels. Vehicular, air traffic, railroad, and construction noise are given an equal weighting factor since these elements are in reality the sources of noise in general. Since noise levels are determined by the cumulative impact of all noise sources, the noise source with the highest impact and significance will most influence the overall noise level of impact and significance.

3.7 Mitigation Measures

Since only negligible, not significant noise impacts have been identified, mitigation measures are not deemed necessary.

3.8 Unavoidable Adverse Impacts

No unavoidable adverse short or long-term noise impacts have been identified through the course of this assessment. It should be noted, however, that there does exist the potential for short duration or nuisance impacts resulting from construction activity.

3.9 Irreversible and Irretrievable Resource Commitments

Implementation of the Proposed Action would result in no irreversible nor irretrievable resource commitments with respect to noise or noise-related impact areas.

3.10 The Relationship Between Local Short-Term Use of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

Implementation of the Proposed Action would result in short duration project-related noise impacts primarily associated with the construction phase of the project. No long-term noise effects are anticipated and, hence, no effects on the maintenance and enhancement of long-term productivity will ensue.

GLOSSARY

4.0 GLOSSARY

4.1 Terms

Ambient Noise: the existing noise which is characteristic of an area.

Annual Average Daily Traffic: denotes daily traffic averaged over 1 calendar year.

Area of Concentrated Study: area(s) within the Region of Influence which will receive the majority of environmental impacts. Analysis of existing environmental conditions are described for, and impacts are focused within, the Area of Concentrated Study for this EPTR.

At-Grade Road: a roadway surface is at the same elevation as surrounding land, rather than on an elevated or depressed right-of-way.

Attenuation: a reduction in the amplitude or energy of a signal such as might be produced by passage through a filter.

Average Daily Traffic: the average number of vehicles passing a specified point during a 24-hour period.

Baseline: the existing characterization of an area under no-project conditions.

Capacity: in transportation studies, the maximum number of vehicles having a reasonable expectation of passing over a given section of a lane or a roadway in one direction (or in both directions for a two-lane or a three-lane highway) during a given time period under prevailing roadway and traffic conditions.

Cartesian Coordinates: coordinates that locate a point on a plane by its measured distance from two straight-line axes which intersect each other at right angles.

Continuous Noise: ongoing noise whose intensity remains at a measurable level (which may vary) without interruption over an indefinite period or a specified period of time.

Count (Traffic): a number of moving vehicles, which may be used for comparison with the present traffic volume assigned to the corresponding link. The count may be directional or total two-way, peak hour morning and/or afternoon, and/or a 24-hour value.

Decibel (dB): a logarithmic unit of measure of sound pressure level used to describe the loudness of sound. When used to correspond to the human range of hearing, decibels are weighted on an A-scale and expressed as dBA.

Design Noise Levels: the noise levels established by the Federal Highway Administration for various activities or land uses which represent the upper limit of acceptable traffic noise level conditions.

Effect: a change in an attribute. Effects can be caused by a variety of events, including those that result from project attributes acting on the resource attribute (direct effect); those that do not result directly from the action or from the attributes of other resources acting on the attribute being studied; those that result from attributes of other projects or other attributes that change due to other projects (cumulative effects); and those that result from natural causes (e.g., seasonal change).

Environmental Noise: by Section 3(11) of the Noise Control Act of 1972, the term "environmental noise" means the intensity, duration, and character of sounds from all sources.

Equivalent Sound Level (L_{eq}): the level of a constant sound which, in a given situation and time period, has the same sound energy as does a time-varying sound. Technically, equivalent sound level is the level of the time-weighted, mean square, A-weighted sound pressure. The time interval over which the measurement is taken should always be specified.

Flat Yard: a type of railroad yard where cars are switched and classified on level ground.

Heavy-Duty Vehicle: a vehicle having three or more axles and designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 26,000 pounds.

Hump Yard: a type of railroad yard where cars are switched by passing over a rise in topography which gives them momentum to travel to different tracks.

Impact: an assessment of the meaning of changes in all attributes being studied for a given resource; an aggregation of all the effects, usually measured using a qualitative and nominally subjective technique.

Intermittent Noise: fluctuating noise whose level falls one or more times to low or unmeasurable values during an exposure.

L_{dn} Noise Level: the 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 PM and 7:00 AM.

L_{eq} Noise Level: a constant amount of acoustic energy equivalent to the energy contained in the time-varying noise measured from a given source for a given time.

L_{10} Noise Level: the sound pressure level expressed in decibels A-weighted (dBA) that is exceeded 10 percent of a given time interval.

L_{90} Noise Level: the sound pressure level expressed in decibels A-weighted (dBA) that is exceeded 90 percent of a given time interval. The noise level closely approximates the background noise level.

Level of Impact: for each environmental resource and its elements, there are specific definitions for negligible, low, moderate, and high impacts for this EPTR.

Level of Service: in transportation studies, a qualitative measure of the flow of traffic along a given road in consideration of a wide variety of factors, including speed and travel time, traffic interruptions, and freedom to maneuver. Levels of service are designated A through F, A being a free-flow condition with low volumes and high speeds, and F being a congested condition of low speeds and stop-and-go traffic. Intermediate levels describe conditions between these extremes.

Light-Duty Vehicle: an automobile or light truck with two axles and four wheels, designed primarily for transportation of nine or fewer passengers (automobiles) or for transportation of cargo (light trucks). Generally, the weight is less than 10,000 pounds.

Long Term: denotes the steady-state operations phase of the project when a constant level of project employment is attained.

Long-Term Impact: after the construction phase and during full operation, an impact occurring from 1990 on.

Mean: a value that is computed by dividing the sum of a set of terms by the number of terms (i.e., average).

Medium-Duty Vehicle: a vehicle having two axles and six wheels designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 10,000 pounds but less than 26,000 pounds.

Mitigations: methods to reduce or eliminate adverse project impacts.

Model: a mathematical formula that expresses the actions and interactions of the elements of a system in such a manner that the system may be evaluated under any given set of conditions.

Noise Contour: a line connecting all points having the same value; e.g., a 65-decibel A-weighted (dBA) contour.

Noise Exposure: the cumulative acoustic stimulation reaching the ear over a specified period of time, e.g., a work shift, a day, a working life, or a lifetime.

Noise Sensitive Areas: specific locations (or general areas) of types of land-use activities which may be affected by traffic noise.

Noncompliance: action contradicting a specified procedure or causing results outside specified limits.

Peak Hour: the 60 minutes observed during either the morning or evening peak traffic period that contains the largest amount of traffic.

Peak Period: the two consecutive morning or evening 60-minute periods that collectively contain the maximum amount of morning or evening traffic. Peak period can be associated with person-trip movement, vehicle-trip movement, or transit trips.

Peak Year: the year which some particular project-related effect, e.g., total employment, is greatest.

Queue Length: length of vehicles backed up at a signalized intersection during the red cycle period.

Region of Influence: the largest region which would be expected to receive measurable impacts from the project.

Rural: that area outside of towns, cities, or communities; characterized by very low density housing concentrations, agricultural land uses, and general lack of most public services.

Short-Term Impact: impact generated during the project construction period; up to 1990.

Significance: the importance to the resource of the impact on the resource. Council of Environmental Quality (CEQ) regulations specify several tests to determine whether an action will significantly affect the quality of the human environment. While these tests apply to the entire action, they can also be used in an amended form to judge impact significance for individual resources. It is important to note that a high impact may not be significant, while a low impact may. Significance is an either/or determination; the level of impact described either is significant or is not significant. Additionally, beneficial significance must be determined at the same level as adverse significance. As specified in the CEQ regulations, significance needs to be determined for each of three geographic areas: local, regional, and national. This places the impact into context. Significance is also determined in terms of intensity.

Sound Exposure Level: the level of sound accumulated over a given time interval or event. Technically, the sound exposure level is the level of the time-integrated mean square A-weighted sound for a stated time interval or event, with a reference time of 1 second.

Sound Level: the quantity in decibels measured by a sound level meter satisfying the requirements of American National Standards Specification for Sound Level Meters S1.4-1971. Sound level is the frequency-weighted sound pressure level obtained with the standardized dynamic characteristic "fast" or "slow" and weighting A, B, or C; unless indicated otherwise, the A-weighting is understood. The unit of any sound level is the decibel, having the unit symbol dB.

Unavoidable Adverse Impact: a project-induced effect determined to be adverse that cannot, and hence will not, be mitigated or avoided.

Urban: descriptive of an area within towns, cities, or communities, characterized by densities greater than one dwelling unit per acre.

Worst-Case: the combination of all the worst possible effects to result potentially from the actions of a project.

4.2 Acronyms

ACS	Area of Concentrated Study
AF	Air Force
AFB	Air Force Base
AFRCE	Air Force Regional Civil Engineer
AFRCE-BMS	Air Force Regional Civil Engineer - Ballistic Missile Support
CNR	Composite Noise Rating
DA	Deployment Area
DAR	Defense Access Road
DEIS	Draft Environmental Impact Statement
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
EPTR	Environmental Planning Technical Report
FAA	Federal Aviation Administration
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
I	Interstate
LF	Launch Facility
NEF	Noise Exposure Forecast
ROI	Region of Influence
RR	Railroad
USAF	United States Air Force
USAFR	United States Air Force Reserve

4.3 Units of Measurement

cm	centimeter
dB	decibel
dBA	decibels weighted on the A-scale
°	degrees (temperature)
°F	degrees Fahrenheit
ft	foot (feet)
h	hour
k	knots
km	kilometer
km/hr	kilometers per hour
kWh	kilowatt hour
lb	pound
L_{dn}	day/night sound level
L_{eq}	time averaged sound energy
L_{10}	10 percent exceedance noise level
L_{50}	50 percent exceedance noise level
L_{90}	90 percent exceedance noise level
m	meter
mi	mile
mph	miles per hour
m/sec	meters per second
sec	second
sq ft	square foot (feet)

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APPENDIX A
AMBIENT NOISE MONITORING PROGRAM

A.1 Introduction

In order to determine existing noise levels in the vicinity of F.E. Warren AFB; Cheyenne, Wyoming; and surrounding communities within the project area, a noise monitoring program was conducted at 14 sites: 11 representative of roadway sites; a residential site bordering Cheyenne Airport property; and 2 sites on property bordering Cheyenne railroad yard property. Noise levels were measured at either 0.2 or 1.0-second intervals for peak-hour periods (i.e., representative of peak traffic volume operations) with a B&K Noise Analyzer. Existing monitored noise levels are shown in Table A.1-1 and are represented by the L_{10}, L_{90}, and L_{eq} noise level measures. The L_{10} (noise level exceeded 10 percent of the time) is a measure of the peak noise level. The L_{90} (noise level exceeded 90 percent of the time) is representative of ambient conditions. The L_{eq} (or equivalent noise level) is an energy-averaged value which assigns a heavier weight to louder noises. Noise monitoring locations for Cheyenne, Wyoming; Kimball, Nebraska; and Wheatland, Wyoming can be found in Figures A.1-1, A.1-2, and A.1-3, respectively. Field sheets containing the noise monitored data, traffic counts, ambient weather conditions, site location, and site and instrumentation characteristics for each site are provided at the end of this Appendix.

A.2 Monitoring Procedures

Noise monitoring was carried out with a B&K Model 4426, Type 0 Noise Analyzer and Statistical Processor, a B&K Type I preamplifier and microphone, and a B&K noise calibrator. At each site, the microphone was placed 5 feet above the ground, clear of any obstacles, and no closer than 10 feet from any reflecting surface. Where possible, noise was monitored on a soft site (grass) 100 feet from the noise source. A wind screen was used at all times. Meteorological parameters, such as wind speed and direction, temperature, and relative humidity, were measured on site and verified with the National Weather Service station in Cheyenne. These data are also shown in Table A.1-1.

Equipment calibration was carried out at the beginning and end of each monitoring period. If the calibration variation was greater than 1.0 dBA or the battery level fell below the recommended threshold within a given monitoring interval, then the data were discarded. Data were also discarded and monitoring discontinued if certain meteorological parameters were exceeded (e.g., high wind speeds) or unusual background noise was present.

Noise source activity was simultaneously recorded manually. In the case of vehicular monitoring, vehicles were classified into light, medium, and heavy-duty categories.. At some monitoring locations, such as Dell Range Boulevard, there were many noise intrusions due to frequent aircraft flyovers. At these locations, the analyzer was switched to standby during the extraneous noise intrusion. This procedure was only carried out at the two roadway sites where the data were to be used to calibrate the STAMINA 2.0 noise model, a model used to predict noise levels from motor vehicle operation, solely.

Table A.1-1

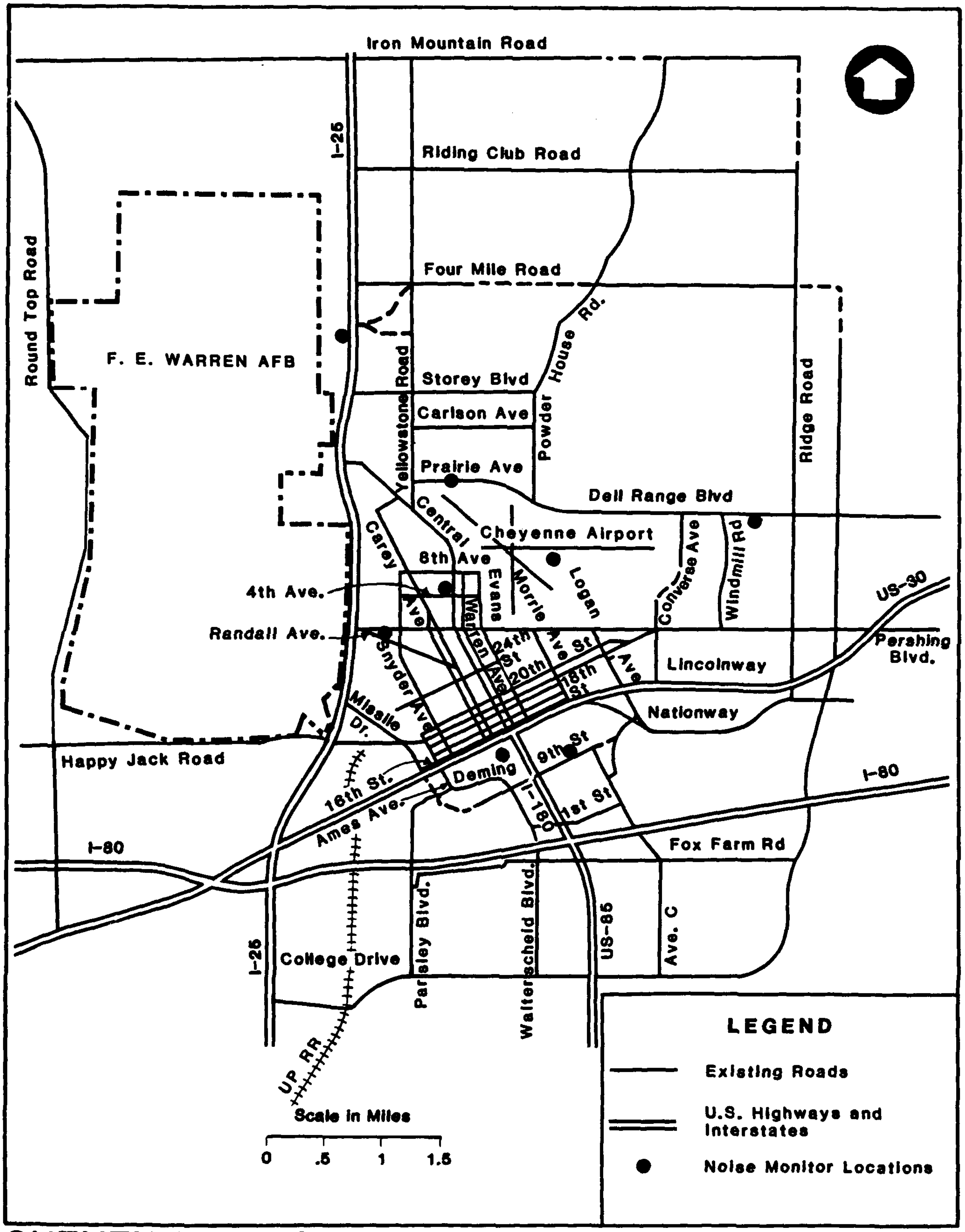
EXISTING MONITORED NOISE LEVELS

Site	Date (1983)	Time Period	Temperature (°F)	Relative Humidity (percent)	Wind Speed (mph)	Wind Direction (Direction From Which Wind is Blowing)	Noise Levels (dBA) L_{10}	L_{90}	L_{eq}
Cheyenne, Wyoming									
Jessup Elementary School Playground, Interstate 25 and Bishop Boulevard	20 January	7:15 to 8:15 am	18	81	3	West	63.3	54.8	60.1
Cahill Municipal Park, Dell Range Boulevard	19 January	4:15 to 5:15 pm	35	54	10	South-Southeast	61.5	51.5	63.1
Church Property, Prairie Avenue West of Townsend Place	30 June	7:15 to 8:15 am	59	63	3	West-Northwest	66.8	53.5	63.7
Right-of-Way Property, Randall Avenue Adjacent to Cribbon Avenue	29 June	7:15 to 8:15 am	50	74	3	Northwest	61.3	51.5	58.3
Residential Property, Central Avenue Adjacent to 4th Avenue	28 June	7:15 to 8:15 am	50	86	2	North	65.5	46.0	61.2
Corner of Residential Property Adjacent to Airport at Intersection of Dirt Service Roads	19 January	2:30 to 3:30 pm	45	54	10	South-Southwest	57.3	37.5	66.2
Cleared Site Adjacent to Southwest End of Railroad Yard	20 January	2:15 to 3:15 pm	40	81	10	Southeast	54.5	48.3	52.4

Table A.1-1 Continued, Page 2 of 2

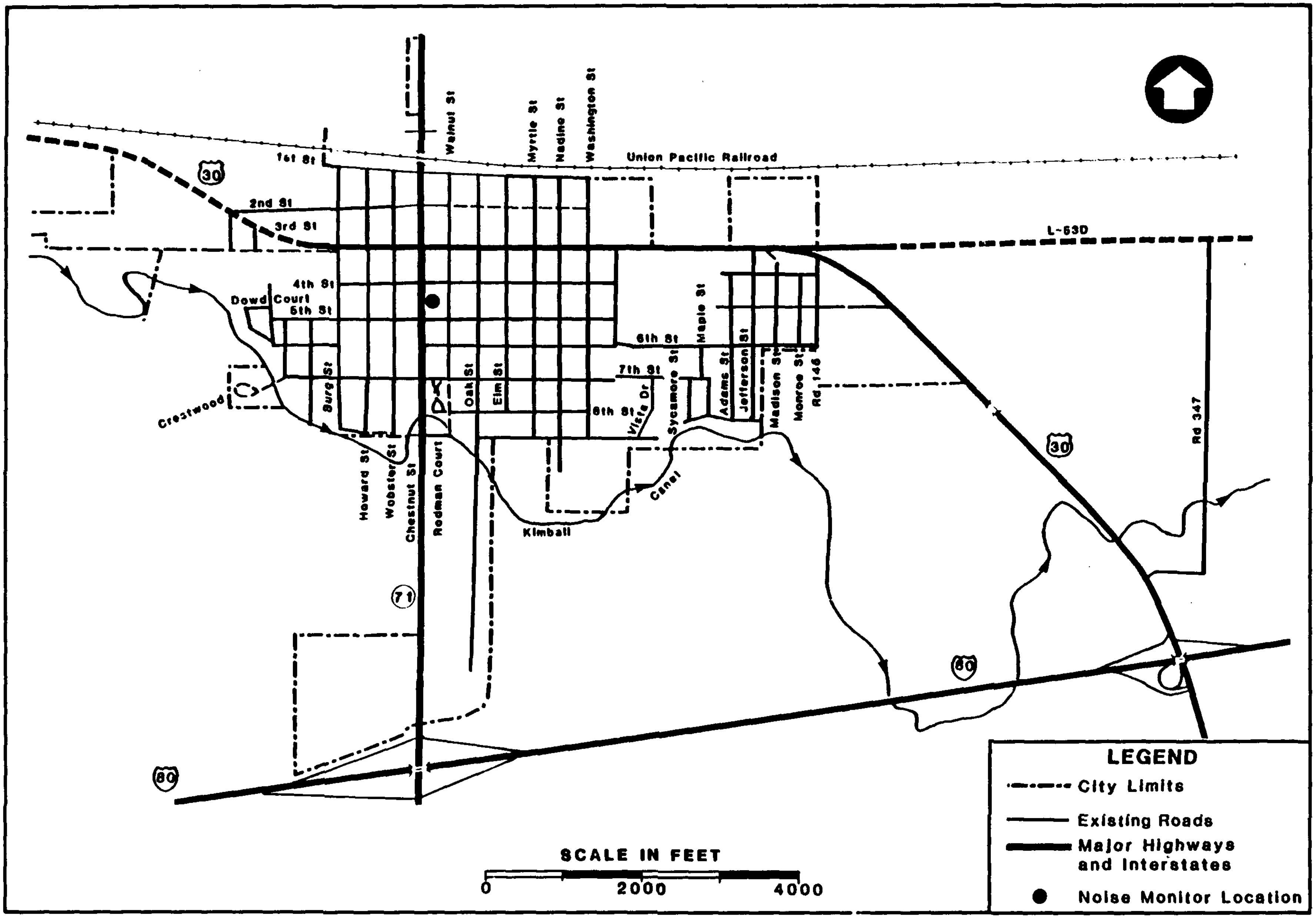
EXISTING MONITORED NOISE LEVELS

Site	Date (1983)	Time Period	Temperature (°F)	Relative Humidity (percent)	Wind Speed (mph)	Wind Direction (Direction From Which Wind is Blowing)	Noise Levels (dBA) L_{10}	L_{90}	L_{eq}
Residential Property Adjacent to Southeast End of Railroad Yard	7 July	8:45 to 9:45 am	77	38	3	Southwest	56.8	42.8	53.7
Torrington, Wyoming									
Residential Property, West C Street North of 26th Avenue	30 June	2:15 to 3:15 pm	86	30	4	West-Northwest	64.8	45.8	61.1
		4:00 to 5:00 pm	84	34	3	West-Northwest	64.5	48.5	61.5
Wheatland, Wyoming									
Residential Property, South Street (Interstate 25) Adjacent to 14th Street	29 June	4:30 to 5:30 pm	81	29	5	West-Northwest	62.0	51.8	59.2
Gering, Nebraska									
Residential Property, Route 92 (M Street) Near 18th Street	6 July	3:00 to 4:00 pm	95	20	7	South	63.0	45.5	58.4
Scottsbluff, Nebraska									
Grass Area, Broadway Between 23rd and 24th Streets	6 July	7:15 to 8:15 am	60	73	1	South	57.5	44.5	54.7
Church Property, 20th Street (Route 29) Between Avenue M and Avenue N	5 July	4:15 to 5:15 pm	87	30	7	South	59.3	42.3	55.8
Kimball, Nebraska									
Residential Property, Route 71 Between 4th and 5th Streets	1 July	2:15 to 3:15 pm	83	41	5	Southwest	62.8	47.0	60.5
		4:15 to 5:15 pm	84	36	4	Southwest	64.0	48.3	61.9



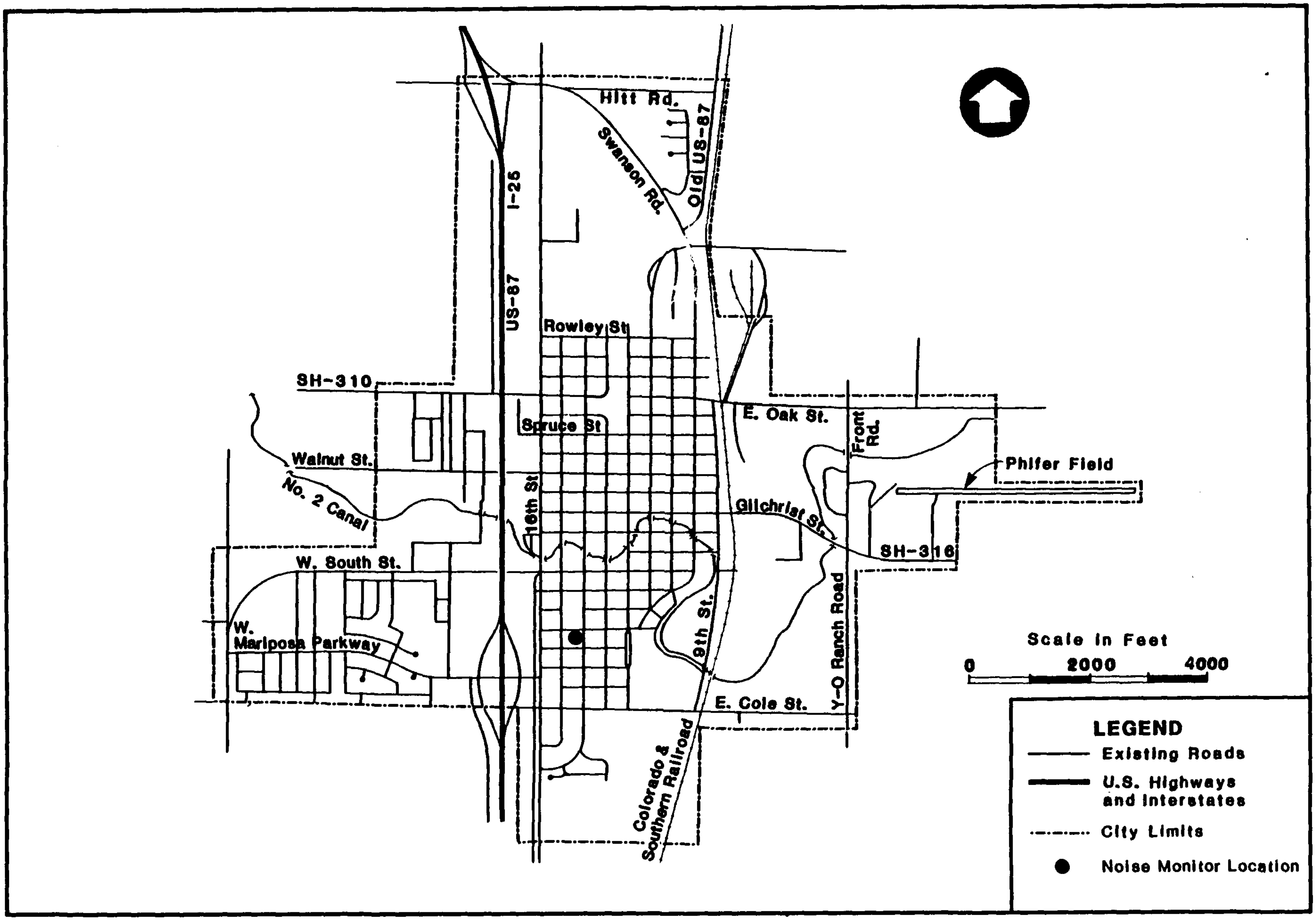
CHEYENNE NOISE MONITORING SITES

FIGURE NO. A.1-1



KIMBALL NOISE MONITORING SITE

FIGURE NO. A.1-2



WHEATLAND NOISE MONITORING SITE

FIGURE NO. A.1-3

The monitoring took place during peak traffic hours for roadway locations. Some of the smaller surrounding communities, such as Kimball, Nebraska, however, do not experience pronounced daily traffic peaks. Aircraft operations and railroad yard activity during monitoring periods at sites adjacent to these facilities were both variable and mobile. Some activity did occur within the monitoring periods; however, these monitoring periods were not of sufficient duration to surmise specific characteristics of associated operational noise levels.

For vehicular noise monitoring, midblock, uninterrupted flow conditions with high volumes were chosen. Speeds and hence, noise are higher in the middle of a block than at intersections. Airport noise was monitored adjacent to the most frequently used runway. Although the loudest noise levels are experienced in line with a runway, the monitoring site was chosen due to its proximity to single-family residential housing adjacent to the airport. Railroad noise was monitored at a gap in the railroad noise wall adjacent to land cleared for multifamily residential development.

A.3 Monitoring Sites

A.3.1 Vehicular Traffic

Two Cheyenne roadway sites, Cahill Park on Dell Range Boulevard and Jessup Elementary School on Interstate 25, were selected to calibrate the STAMINA 2.0 noise model. These roadways were selected as being generally representative of area roadway characteristics. Traffic volumes, vehicle speeds, vehicle mix, and noise levels were simultaneously measured for 1 hour during a period of peak traffic flow. Both sites are adjacent to residential areas. The site on Dell Range Boulevard has a 3-percent upgrade for westbound traffic, while the Interstate 25 site has a 3-percent upgrade for northbound traffic. Dell Range Boulevard has one lane of traffic in each direction. Traffic lanes are 12 feet wide. Interstate 25 has two 12-foot lanes of traffic in each direction, a 16-foot wide median, and 6-foot shoulders. Bishop Boulevard is a service roadway which parallels Interstate 25. It has one 12-foot lane of traffic in each direction, and is 25 feet from Interstate 25.

Background noise levels at the park on Dell Range Boulevard included aircraft flyovers, parking lot traffic, wind, and people using the park. Much of the aircraft noise was eliminated by turning the instrument to standby when the noise became noticeable. This was done because the loudness of the aircraft noise could significantly bias the monitor's readings of the traffic noises that were being monitored at the site. At the school playground on Interstate 25, ambient noise levels were from traffic on Bishop Boulevard which parallels Interstate 25 and from local traffic on side streets bordering the school. Again, noise from aircraft flyovers was omitted from the calculations by turning the instrument to standby during flyover periods.

The existing traffic-generated noise levels at the park and playground sites and comparisons with the values predicted by STAMINA 2.0 are shown in Table A.3-1. The L_{10} values predicted by STAMINA 2.0 are within 1 dBA of monitored values. The site at the school playground on Interstate 25 also shows good correspondence between the monitored L_{eq} and the predicted L_{eq} values. However, the model underpredicted the L_{eq} for the park site along Dell Range Boulevard. This is undoubtedly due to the site's proximity to the

Table A.3-1

TRAFFIC GENERATED NOISE LEVELS: MONITORED VALUES VS. PREDICTED VALUES

Location	Peak 1-Hour Values (dBA)				Vehicle Volumes				
	Monitored		Predicted		Light-Duty	Medium-Duty	Heavy-Duty	Motor-cycles	Speed
	L_{10}	L_{eq}	L_{10}	L_{eq}					
Jessup Elementary School Playground (Interstate 25)	63.3	60.1	64.0	60.5	503	10	22	0	35-55 mph
Cahill Municipal Park (Dell Range Boulevard)	61.5	63.1	61.4	57.9	802	13	1	4	35 mph

airport and the frequency of aircraft flyovers during the monitoring period. Although the noise analyzer was turned to standby during the loudest periods of aircraft activity, low-level aircraft noise may have been frequent enough to affect the L_{eq} values, especially because calculations for the L_{eq} give greater weight to the loudest noise levels monitored.

Three additional roadway sites in Cheyenne were monitored: a church property on Prairie Avenue, a grassy area within the right-of-way on Randall Avenue, and a residential property on Central Avenue. All three sites were representative of residential areas and set back from the roadway at distances equal to typical house locations. The Prairie Avenue site experienced nearby airport noise as an ambient source. The roadway consists of two westbound lanes carrying approximately two-thirds of the morning peak traffic and one eastbound lane. Ambient noise at the Randall Avenue site was due mainly to nearby Pershing Boulevard and the Interstate 25 overpass. The truck traffic climbing the upgrade on Interstate 25 was particularly noticeable, even at a distance of 1,000 feet. The roadway itself consists of one lane in each direction. The monitoring site on Central Avenue experienced the lowest ambient noise level (see the L_{90} in Table A.1-1). The roadway consists of two southbound lanes. Some influence was encountered from nearby Fourth Avenue.

In general, all roadway lanes adjacent to the monitoring sites were 12 feet wide and somewhat undefined with wide shoulders except for Prairie Avenue where lanes and shoulders were narrower. A high proportion of the light-duty vehicles at most of the sites consisted of pickup trucks, four-wheel drive vehicles, and modified exhaust system vehicles.

To further ascertain existing noise levels in surrounding communities, roadway noise monitors were set up in Kimball, Gering, and Scottsbluff, Nebraska, and Wheatland and Torrington, Wyoming. In nearly all cases, the optimal roadway-monitor distance of 100 feet could not be attained due to the proximity of residences to the road. One monitor had to be set as close as 39 feet from the closest travel lane. However, due to the low traffic volumes and cruise speeds, noise levels were comparatively low. Most roadways consisted of one 12-foot lane in each direction, somewhat undefined unless close to an intersection, and a wide shoulder with scattered parking. Within the cities, speed limits were generally low, on the order of 20 to 30 mph. In all cases, ambient noise was low, consisting mainly of dogs barking, lawnmowers, etc. Route 71 in Kimball experienced a high proportion of heavy-duty trucks from Interstate 80 to the south.

A.3.2 Airport Operations

Existing noise levels were monitored at a residential property adjacent to the Cheyenne Airport for 1 hour at 1-second intervals. A B&K Type 4426 Noise Analyzer was set up 50 feet from the airport boundary at a point approximately one-fourth mile from Runway 26, the most frequently used, and one-eighth of a mile from Runway 30. The microphone was placed 5 feet above the ground and a wind screen was used at all times. Meteorological data were obtained from the Cheyenne National Weather Service station, as well as from a hand-held anemometer and thermometer.

In addition to the landings and takeoffs observed at Runways 26 and 30, a number of aircraft flew over the monitoring site. Background levels represented noise from side streets, an arterial roadway several blocks away, barking dogs, hammering, and a small chainsaw used several houses away.

Due to the skewed nature of the monitoring data, which included peak levels of 88 dB, the L_{eq} was higher than the L_{10}. The noise level data are presented in Table A.1-1.

A.3.3 Railroad Operations

Noise monitors were also set up at two different locations on the southern boundary of the Cheyenne railroad yard, where residences are located adjacent to the railroad yard. Homes north of the yard are well-buffered by commercial and industrial areas, while homes adjacent to the southern boundary of the yard are frequently shielded by lines of cars which are stored on outside tracks. A noise wall was constructed along the southwest portion of the yard in 1982 to provide additional noise shielding for a site which has been cleared for single-story apartment construction.

One monitoring location abutted the southwest portion of the yard on a cleared site at an opening in the noise wall. The microphone was placed 5 feet above the ground and was approximately 150 feet from the area where switching operations were taking place. The site was further shielded by three tracks of stored cars. A wind screen was used at all times. Noise levels were measured at 1-second intervals for 1 hour. During this hour, one train passed through the station and classification of cars was occurring. Background noise at the railroad site was due primarily to noise from aircraft flyovers and from Interstate 180, several blocks away. Other sources of background noise at the railroad yards included local highway construction activities and hissing from a nearby gas main.

The other railroad yard monitoring site was in a backyard of a residence on East Tenth Street, along the southeast portion of the yard, 125 feet from the closest track. Synchronization of monitoring with peak activity at the railroad yard was attempted by coordinating with the railroad Station Yardmaster. The monitoring site was in a 3-foot depressed area with 3 rows of parked railroad cars acting as a shield. Ambient noise was due, in large part, to some activity in a nonrailroad storage yard used for highway construction materials. Noise level data from both railroad yard sites are presented in Table A.1-1.

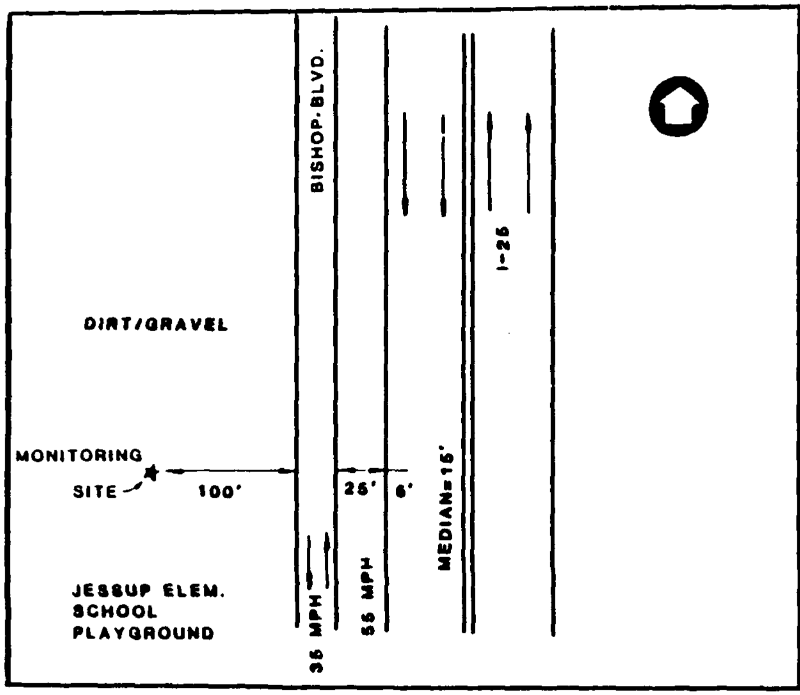
Ambient Noise Monitoring

Program

Field Note Sheets

Project No. EX 299   Location: CHEYENNE, Interstate 25   Observer(s): NEUMAN, MINNICINO

Site No. C   Date: 1/20/83   Day: S M T W (Th) F S   Time Period: 7:15 - 8:15 (AM)/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 1-2 K/H
Temp/Rel Hum: 18°F/81%
General Weather: CLEAR
No. Samples: 3,600
Sample Period: 1 SEC
Range: 36-100 Response: FAST/INST
Batt Before/After: 7.36 7.11
Cal Before/After: 93.5 93.8
Equipment Used: B+K 4426 ANAL., B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: High % OF PICKUPS

Time Period: 7:15 - 8:15 (AM)/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	415	88						
Medium Trucks/Buses	10							
Heavy Trucks	22							
Motorcycles								
Flyovers/	1							

NUMBER 1

Instrument Output

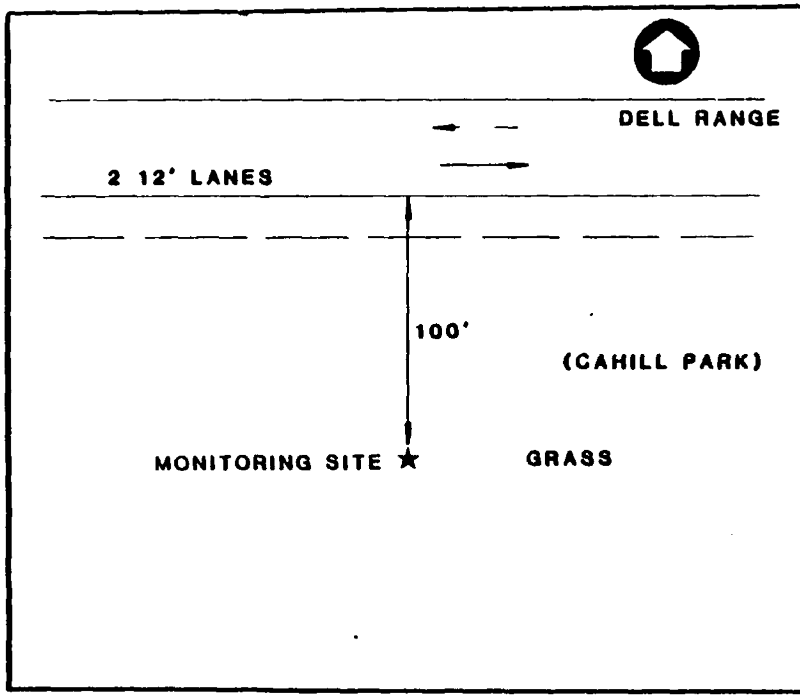
L_{10} 63.3 L_{50} 58.5
L_{90} 54.8 L_{99} 52.0
L_{eq} 60.1

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.0
8-10	0.0
10-12	0.1
12-14	0.2
14-16	0.6
16-18	5.8
18-20	14.0
20-22	22.7
22-24	24.9
24-26	16.5
26-28	7.0
28-30	3.9
30-32	1.8
32-34	0.8
34-36	0.1
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

Project No. EX 299 Location: CHEYENNE, DELL RANGE BOULEVARD Observer(s): NEIMAN, MINNICINO

Site No. B Date: 1/19/83 Day: S M T W Th F S Time Period: 4:15-5:15 AM/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 2-9 K/SSE
Temp/Rel Hum: 35°F/54%
General Weather: CLEAR
No. Samples: 3,600
Sample Period: 1 SEC
Range: 36-100 Response: FAST/INST
Batt Before/After: 7.31 6.86
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC B+K 4230 CALIB
Comments: 1 HDV (SNOW REMOVAL)

Instrument Output

L_{10} 61.5 L_{50} 57.5

L_{90} 51.5 L_{99} 47.8

L_{eq} 63.1

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.0
8-10	0.3
10-12	1.2
12-14	4.1
14-16	6.5
16-18	9.3
18-20	14.4
20-22	21.5
22-24	21.8
24-26	13.5
26-28	4.4
28-30	1.3
30-32	0.3
32-34	0.1
34-36	0.1
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

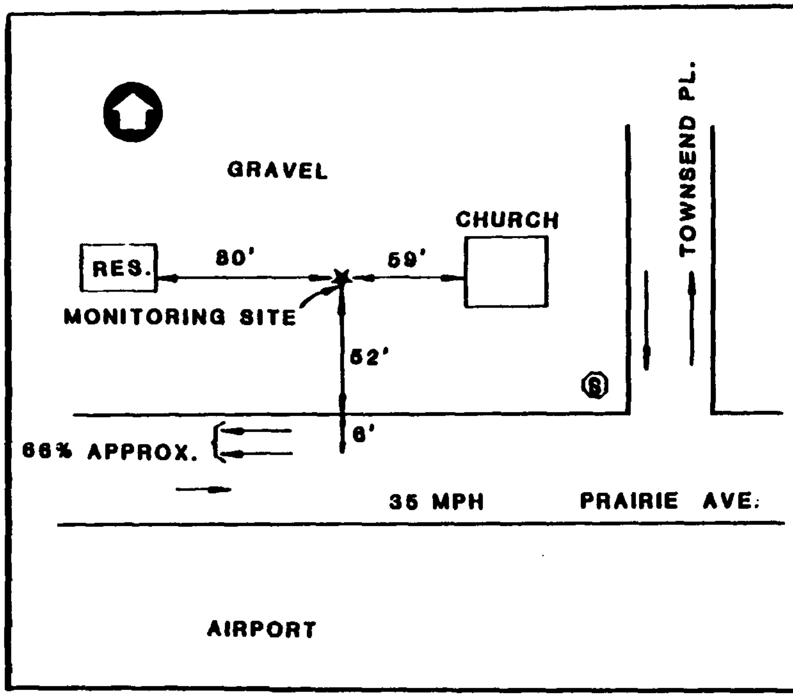
Time Period: 4:15-5:15 AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	802							
Medium Trucks	13							
Heavy Trucks	1							
Buses	3							
Motorcycles	4							
Flyovers/								

NUMBER 2

Project No. EX 299 Location: CHEYENNE, PRAIRIE AVENUE Observer(s): MINNICINO, BURACK

Site No. 03 Date: 6/30/83 Day: S M T W (Th) F S Time Period: 7:15-8:15 (AM) PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 3 MPH/WNW
Temp/Rel Hum: 59°F/63%
General Weather: PARTLY CLOUDY
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST
Batt Before/After: - 7.01
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP. B+K 4165 MIC B+K 4230 CALIB
Comments: CONSTR. VEH. FROM AIRPORT

Instrument Output

L_{10} 66.8 L_{50} 61.0
L_{90} 53.5 L_{99} ___
L_{eq} 63.7

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.0
8-10	0.0
10-12	0.0
12-14	0.5
14-16	4.4
16-18	7.6
18-20	9.0
20-22	10.6
22-24	11.5
24-26	14.6
26-28	15.3
28-30	11.9
30-32	6.7
32-34	3.2
34-36	1.6
36-38	0.7
38-40	0.5
40-42	0.1
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

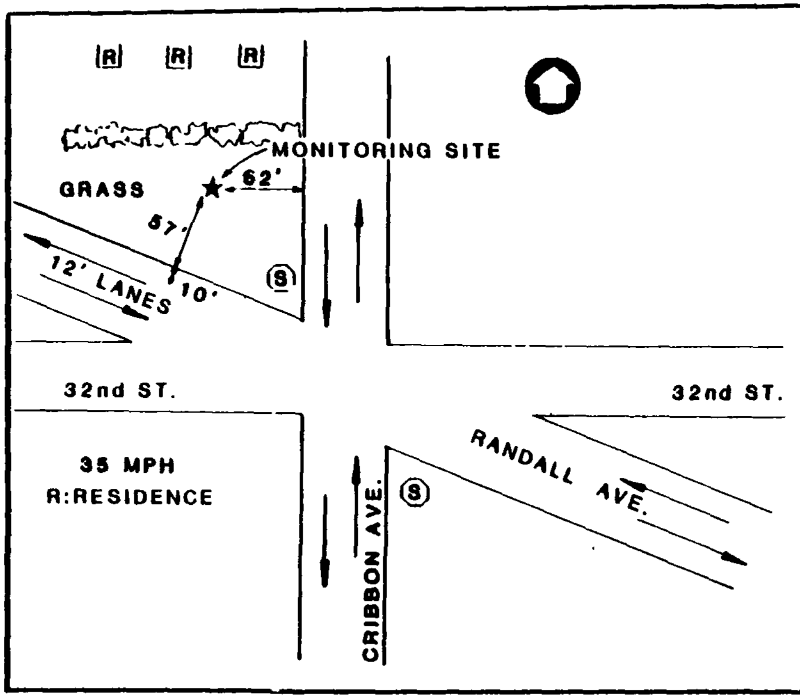
Time Period: 7:15-8:15 (AM) PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	855							
Medium Trucks/Buses	25							
Heavy Trucks	6							
Motorcycles	15							
Flyovers/ ___								

NUMBER 3

Project No. EX 299   Location: CHEYENNE, RANDALL AVENUE   Observer(s): MINNICINO, BURACK

Site No. 02   Date: 6/29/83   Day: S M T (W) Th F S   Time Period: 7:15-8:15 (AM)/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 3 MPH/NW
Temp/Rel Hum: 50°F/74%
General Weather: CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST
Batt Before/After: - 6.96
Cal Before/After: 93.5 93.3
Equipment Used: B+K 4426 ANAL
B+K 2619 PREAMP, B+K 4165 MIC,
B+K 4230 CALIB.
Comments: HIGH % OF PICKUPS

Time Period: 7:15-8:15 (AM)/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	414							
Medium Trucks/Buses	2							
Heavy Trucks	2							
Motorcycles	4							
Flyovers/								

NUMBER 4

Instrument Output

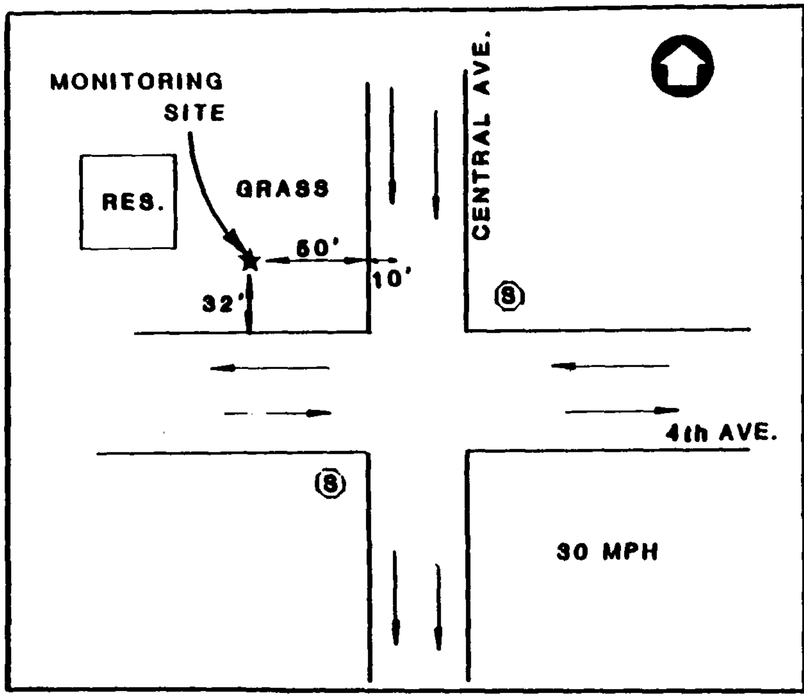
L_{10} 61.3 L_{50} 56.5
L_{90} 51.5 L_{99} 49.3
L_{eq} 58.3

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.0
8-10	0.0
10-12	0.0
12-14	3.2
14-16	9.6
16-18	14.5
18-20	18.6
20-22	19.7
22-24	17.4
24-26	9.4
26-28	4.0
28-30	1.2
30-32	0.3
32-34	0.1
34-36	0.1
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

Project No. EX 299   Location: CHEYENNE, CENTRAL AVENUE   Observer(s): MINNICINO, BURACK

Site No. 01   Date: 6/28/83   Day: S M (T) W Th F S   Time Period: 7:15-8:15 (AM) PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 2 MPH/N
Temp/Rel Hum: 50°F/86%
General Weather: MOSTLY CLOUDY
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100   Response: FAST/INST
Batt Before/After: - 6.96
Cal Before/After: 93.5 93.8
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: PICKUPS, SNOW TIRES

Time Period: 7:15-8:15 (AM)/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	805	15						
Medium Trucks/Buses	16							
Heavy Trucks	2							
Motorcycles	5							
Flyovers/ ______								

Instrument Output

L_{10} 65.5 L_{50} 58.8
L_{90} 46.0 L_{99} 41.3
L_{eq} 61.2

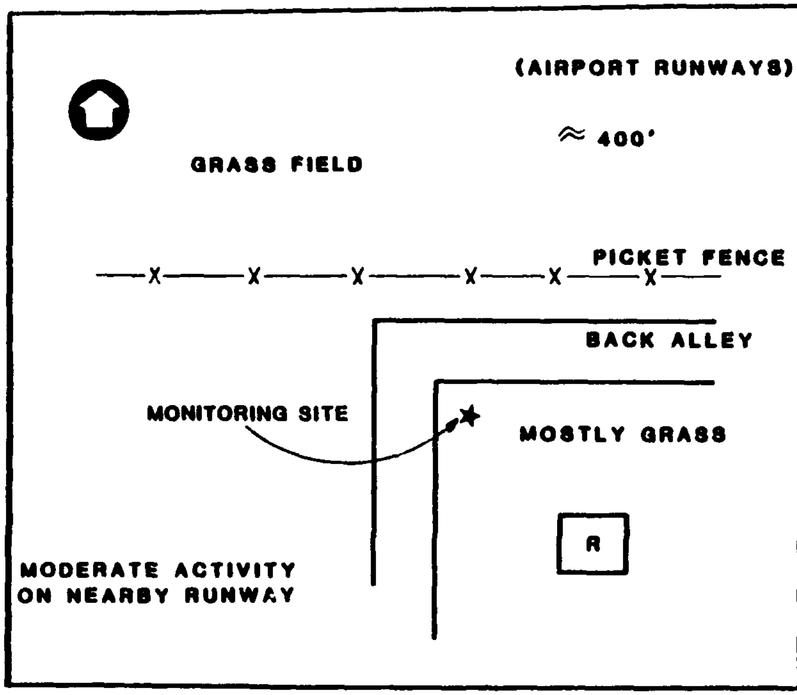
Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	1.4
6-8	3.3
8-10	5.1
10-12	6.2
12-14	5.8
14-16	5.5
16-18	5.1
18-20	5.6
20-22	7.4
22-24	8.8
24-26	12.2
26-28	11.7
28-30	12.2
30-32	6.2
32-34	1.0
34-36	0.0
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

NUMBER 5

Project No. EX 299 Location: CHEYENNE AIRPORT Observer(s): NEUMAN, MINNICINO

Site No. A Date: 1/19/83 Day: S M T W Th F S Time Period: 2:30-3:30 AM/PM



Checklist

Receptor
- o Distance o Surface
- o Elevation o Address

Roadways
- o Width o Shoulders
- o No. Lanes o Speeds
- o Surface o Stop Signs
- o Signals o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 1-9 K/SSW
Temp/Rel Hum: 45°F/54%
General Weather: CLEAR
No. Samples: 3,600
Sample Period: 1.0 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: 7.26 6.86
Cal Before/After: 93.5 -
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: CHAINSAW SOME DISTANCE AWAY

Instrument Output

L_{10} 57.3 L_{50} 42.8

L_{90} 37.5 L_{99} 36.3

L_{eq} 66.2

Noise Level Distribution (percent of time)

0-2	9.7
2-4	13.6
4-6	18.0
6-8	12.3
8-10	8.4
10-12	5.2
12-14	4.3
14-16	3.6
16-18	4.1
18-20	3.7
20-22	3.1
22-24	1.3
24-26	1.5
26-28	1.0
28-30	0.7
30-32	0.6
32-34	0.5
34-36	0.4
36-38	0.2
38-40	0.3
40-42	0.2
42-44	0.2
44-46	0.2
46-48	0.0
48-50	0.1
50-52	0.0
52-54	0.1
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

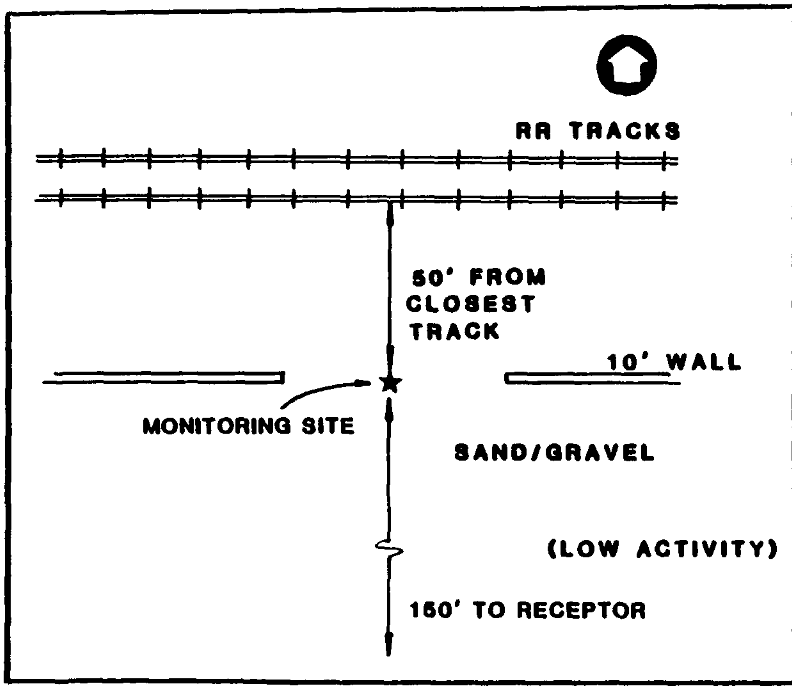
Time Period: 2:30-3:30 AM/PM

TAKEOFF / LANDING	RUNWAY 26	RUNWAY 30	C	D	E	F	G	H
General	-	13/0						
Commercial Jet	1/0	-						
Military Helicopter	1/1	-						
Military C-130	1/2	-						

NUMBER 6

Project No. EX 299 Location: CHEYENNE RAILROAD YARD Observer(s): NEUMAN, MINNICINO

Site No. D Date: 1/20/83 Day: S M T W Th F S (Th circled) Time Period: 2:15-3:15 AM/PM (AM circled)



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 5-9 K/SE
Temp/Rel Hum: 40°F/81%
General Weather: PARTLY CLOUDY
No. Samples: 3,600
Sample Period: 1.0 SEC
Range: 46-110 Response: FAST/INST.
Batt Before/After: - 6.81
Cal Before/After: 93.5 -
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC. B+K 4230 CALIB.
Comments: HIGH AMBIENT

Instrument Output

L_{10} 54.5 L_{50} 50.5
L_{90} 48.3 L_{99} 47.0
L_{eq} 52.4

Noise Level Distribution (percent of time)

0-2	7.2
2-4	35.1
4-6	27.9
6-8	16.1
8-10	7.9
10-12	2.5
12-14	1.2
14-16	0.5
16-18	0.3
18-20	0.1
20-22	0.0
22-24	0.0
24-26	0.0
26-28	0.0
28-30	0.0
30-32	0.0
32-34	0.0
34-36	0.0
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

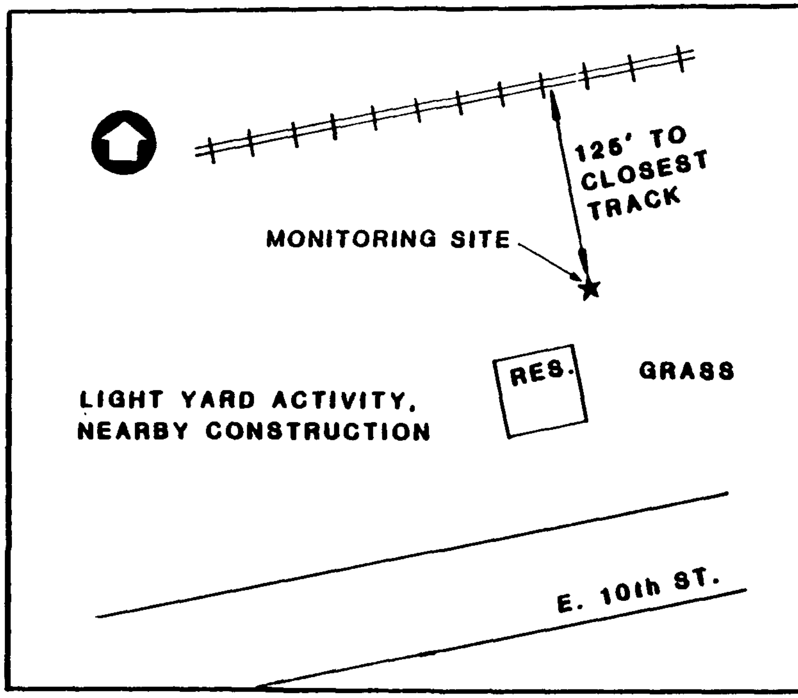
Time Period: N/A AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks								
Medium Trucks								
Heavy Trucks								
Buses								
Motorcycles								
Flyovers/ ______								

NUMBER 7

Project No. EX 299 Location: CHEYENNE RAILROAD YARD Observer(s): MINNICINO, BURACK

Site No. 10 Date: 7/7/83 Day: S M T W Th F S Time Period: 8:45-9:45 AM PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 3 MPH/SW
Temp/Rel Hum: 77°F/38%
General Weather: CLEAR SKIES
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 7.11
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP. B+K 4165 MIC. B+K 4230 CALIB.
Comments: HIGH AMBIENT

Instrument Output

L_{10} 56.8 L_{50} 46.8
L_{90} 42.8 L_{99} 40.3
L_{eq} 53.7

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.7
4-6	5.6
6-8	15.6
8-10	21.3
10-12	19.2
12-14	10.8
14-16	6.2
16-18	4.6
18-20	3.7
20-22	2.8
22-24	2.6
24-26	2.3
26-28	1.2
28-30	0.8
30-32	0.3
32-34	0.1
34-36	0.0
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

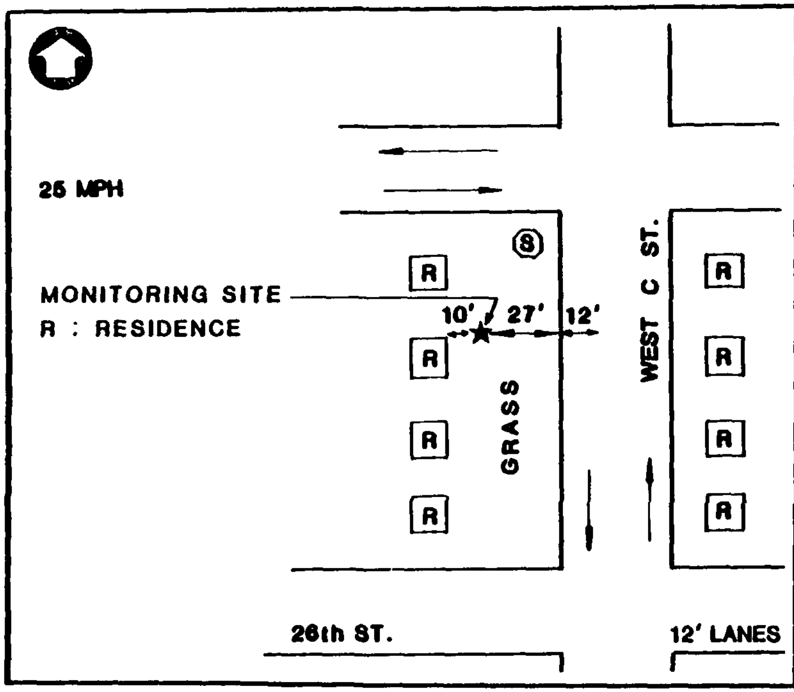
Time Period: N/A AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks								
Medium Trucks								
Heavy Trucks								
Buses								
Motorcycles								
Flyovers/								

NUMBER 8

Project No. EX 299 Location: TORRINGTON, WEST C STREET Observer(s): MINNICINO, BURACK

Site No. 05A Date: 6/30/83 Day: S M T W Th F S Time Period: 2:15-3:15 AM/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 4 MPH/WNW
Temp/Rel Hum: 86°F/30%
General Weather: PARTLY CLOUDY
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 7.01
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC. B+K 4230 CALIB.
Comments: LOUD EXHAUST SYSTEMS

Time Period: 2:15-3:15 AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	368							
Medium Trucks/Buses	14							
Heavy Trucks	5							
Motorcycles	1							
Flyovers/								

NUMBER 9

Instrument Output

L_{10} 64.8 L_{50} 56.3

L_{90} 45.8 L_{99} 40.0

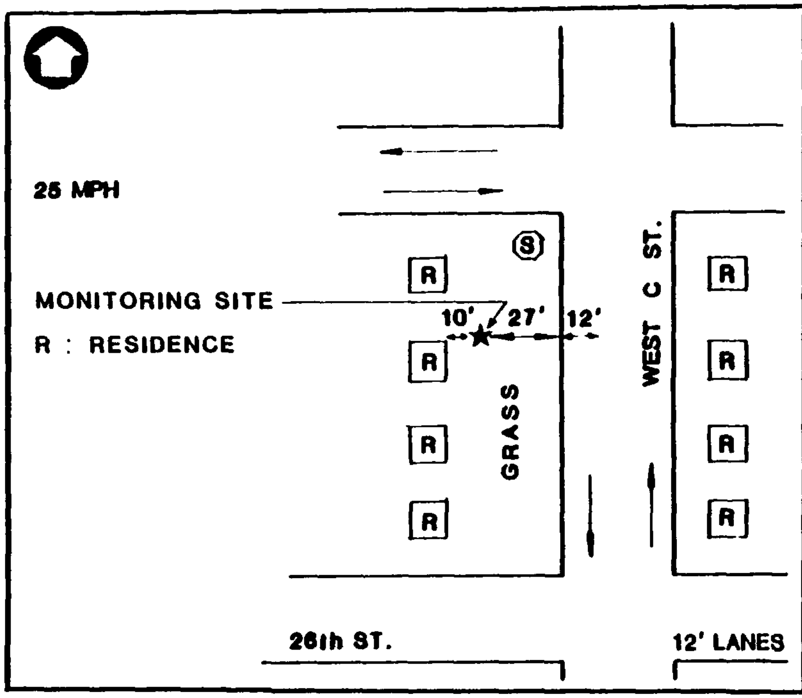
L_{eq} 61.1

Noise Level Distribution (percent of time)

0-2	0.1
2-4	0.5
4-6	1.2
6-8	3.3
8-10	5.6
10-12	7.8
12-14	8.0
14-16	7.4
16-18	6.9
18-20	7.1
20-22	8.0
22-24	9.0
24-26	10.8
26-28	9.6
28-30	6.5
30-32	3.2
32-34	1.4
34-36	0.5
36-38	0.1
38-40	0.1
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

Project No. EX 299 Location: TORRINGTON, WEST C STREET Observer(s): MINNICINO, BURACK

Site No. 05B Date: 6/30/83 Day: S M T W Th F S Time Period: 4:00-5:00 AM PM



Checklist

Receptor
- o Distance o Surface
- o Elevation o Address

Roadways
- o Width o Shoulders
- o No. Lanes o Speeds
- o Surface o Stop Signs
- o Signals o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 3 MPH/WNW
Temp/Rel Hum: 84°F/34%
General Weather: MOSTLY CLOUDY
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 7.61
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC. B+K 4230 CALIB.
Comments: LAWNMOWER 2 HOUSES DOWN

Instrument Output

L_{10} 64.5 L_{50} 56.5
L_{90} 48.5 L_{99} 43.0
L_{eq} 61.5

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.3
6-8	0.8
8-10	2.4
10-12	4.6
12-14	7.1
14-16	8.5
16-18	11.3
18-20	11.2
20-22	10.4
22-24	9.2
24-26	10.4
26-28	9.7
28-30	6.4
30-32	2.8
32-34	1.4
34-36	0.3
36-38	0.1
38-40	0.3
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

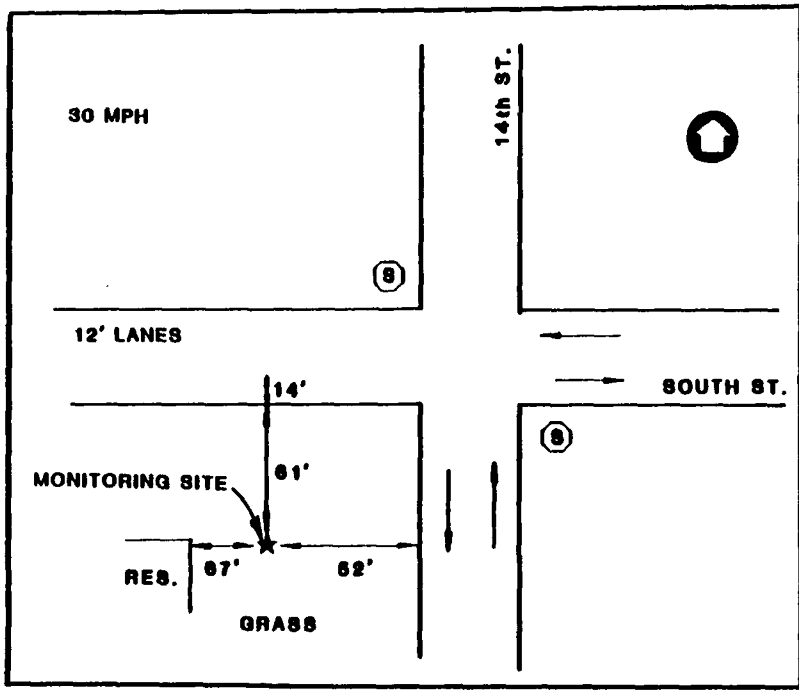
Time Period: 4:00-5:00 AM PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	367							
Medium Trucks/Buses	5							
Heavy Trucks	2							
Motorcycles	4							
Flyovers/								

NUMBER 10

Project No. EX 299 Location: WHEATLAND, SOUTH STREET Observer(s): MINNICINO, BURACK

Site No. 04 Date: 6/29/83 Day: S M T (W) Th F S Time Period: 4:30-5:30 AM/(PM)



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 5 MPH/WNW
Temp/Rel Hum: 81°F/29%
General Weather: CLEAR SKIES
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 7.06
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: SOME HIGH NOISE VEHICLES

Instrument Output

L_{10} 62.0 L_{50} 56.8
L_{90} 51.8 L_{99} 47.8
L_{eq} 59.2

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.0
8-10	0.0
10-12	1.0
12-14	3.2
14-16	7.2
16-18	13.1
18-20	17.6
20-22	22.2
22-24	16.0
24-26	8.3
26-28	4.6
28-30	2.3
30-32	1.4
32-34	0.8
34-36	0.3
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

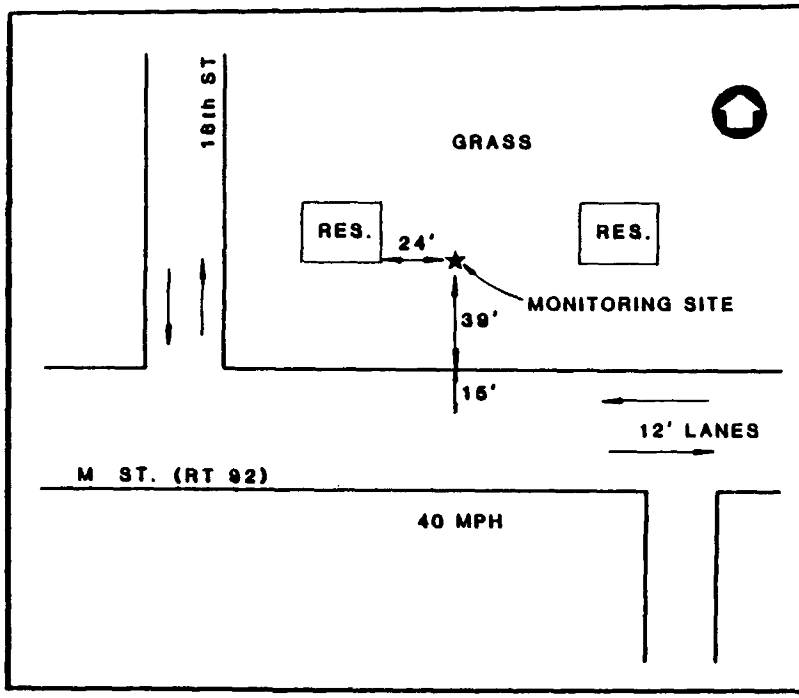
Time Period: 4:30-5:30 AM/(PM)

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	500	56						
Medium Trucks / Buses	17							
Heavy Trucks	10							
Motorcycles	20							
Flyovers/ ______								

NUMBER 11

Project No. EX 299 Location: GERING, M STREET (ROUTE 92) Observer(s): MINNICINO, BURACK

Site No. 09 Date: 7/6/83 Day: S M T W Th F S Time Period: 3:00-4:00 AM/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 7 MPH+/S
Temp/Rel Hum: 95°F/20%
General Weather: MOSTLY CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 6.91
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC. B+K 4230 CALIB.
Comments: LOUD EXHAUST SYSTEMS

Instrument Output

L_{10} 63.0 L_{50} 53.0

L_{90} 45.5 L_{99} 42.5

L_{eq} 58.4

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.3
6-8	3.3
8-10	10.3
10-12	12.9
12-14	9.6
14-16	8.1
16-18	9.0
18-20	8.1
20-22	7.2
22-24	8.0
24-26	8.5
26-28	6.7
28-30	3.3
30-32	1.4
32-34	0.5
34-36	0.3
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

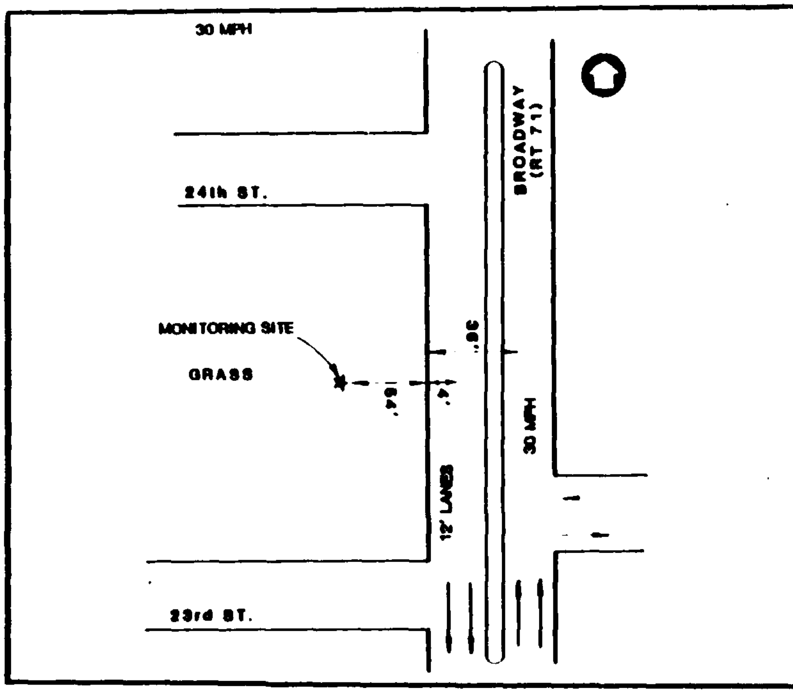
Time Period: 3:00-4:00 AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	281							
Medium Trucks/Buses	8							
Heavy Trucks	9							
Motorcycles	9							
Flyovers/								

NUMBER 12

Project No. EX 299 Location: SCOTTSBLUFF, BROADWAY (ROUTE 71) Observer(s): MINNICINO, BURACK

Site No. 08 Date: 7/6/83 Day: S M T (W) Th F S Time Period: 7:15-8:15 (AM)/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 1 MPH/S
Temp/Rel Hum: 60°F/73%
General Weather: CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 6.96
Cal Before/After: 93.5 92.5
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: CONSTR. 1/4 MILE AWAY

Time Period: 7:15-8:15 (AM)/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	171							
Medium Trucks/Buses	1							
Heavy Trucks	3							
Motorcycles	6							
Flyovers/								

Instrument Output

L_{10} 57.5 L_{50} 50.0
L_{90} 44.5 L_{39} 41.5
L_{eq} 54.7

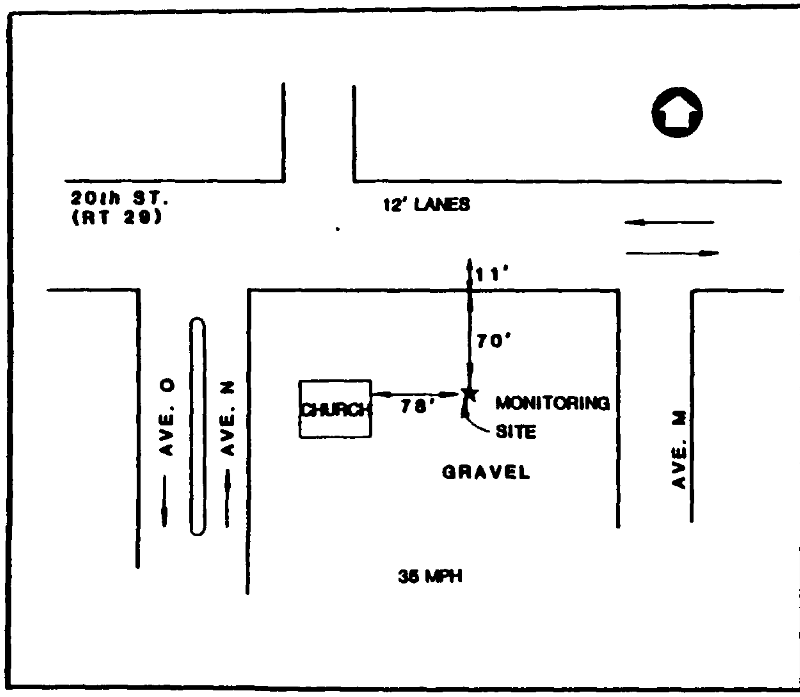
Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	1.7
6-8	6.9
8-10	12.1
10-12	14.5
12-14	15.4
14-16	13.1
16-18	11.2
18-20	8.7
20-22	6.9
22-24	4.0
24-26	1.7
26-28	0.7
28-30	0.3
30-32	0.1
32-34	0.1
34-36	0.0
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

NUMBER 13

Project No. EX 299   Location: SCOTTSBLUFF, 20TH STREET (ROUTE 29)   Observer(s): MINNICINO, BURACK

Site No. 07   Date: 7/5/83   Day: S M T W Th F S   Time Period: 4:15-5:15 AM/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 7 MPH+/S
Temp/Rel Hum: 87°F/30%
General Weather: CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 6.96
Cal Before/After: 93.5 93.8
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: ACCEL. VEH FROM AVE. N.

Instrument Output

L_{10} 59.3 L_{50} 50.5

L_{90} 42.3 L_{99} 39.5

L_{eq} 55.8

Noise Level Distribution (percent of time)

0-2	0.0
2-4	1.9
4-6	6.7
6-8	9.7
8-10	11.2
10-12	9.6
12-14	8.3
14-16	8.7
16-18	9.4
18-20	10.3
20-22	8.7
22-24	6.4
24-26	3.2
26-28	1.9
28-30	1.2
30-32	0.3
32-34	0.1
34-36	0.0
36-38	0.0
38-40	0.0
40-42	0.0
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

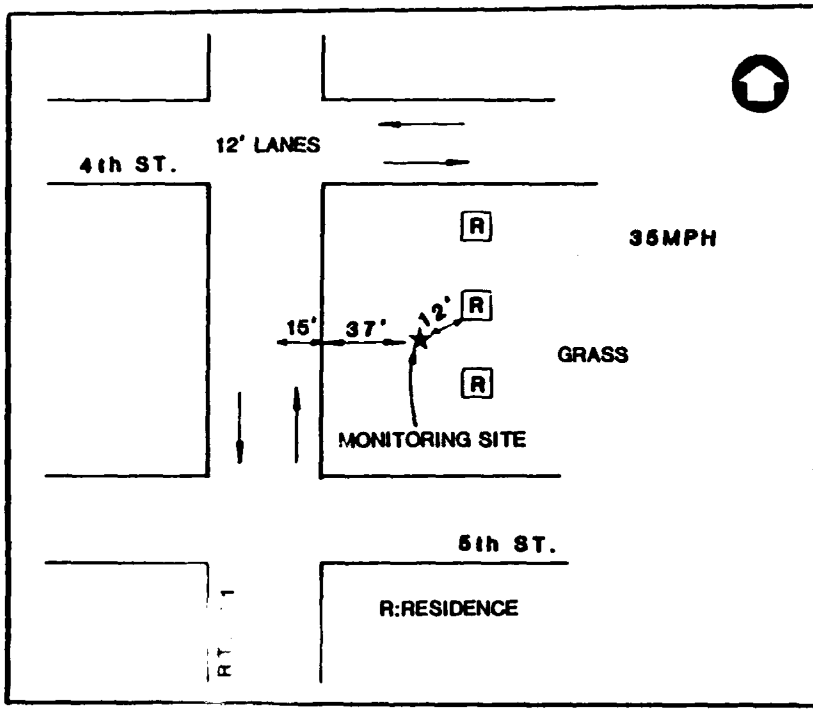
Time Period: 4:15-5:15 AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	324							
Medium Trucks/Buses	11							
Heavy Trucks	1							
Motorcycles	7							
Flyovers/								

NUMBER 14

Project No. EX 299 Location: KIMBALL, ROUTE 71 Observer(s): MINNICINO, BURACK

Site No. 06A Date: 7/1/83 Day: S M T W Th F S Time Period: 2:15-3:15 AM/PM



Checklist

Receptor
- o Distance
- o Elevation
- o Surface
- o Address

Roadways
- o Width
- o No. Lanes
- o Surface
- o Signals
- o Shoulders
- o Speeds
- o Stop Signs
- o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 5 MPH+/SW
Temp/Rel Hum: 83°F/41%
General Weather: MOSTLY CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 7.11
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL. B+K 2619 PREAMP, B+K 4165 MIC. B+K 4230 CALIB.
Comments: HIGH TRUCK % OFF 1-80

Time Period: 2:15-3:15 AM/PM

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	331							
Medium Trucks/Buses	15							
Heavy Trucks	21							
Motorcycles	1							
Flyovers/								

Instrument Output

L_{10} 62.8 L_{50} 54.3

L_{90} 47.0 L_{99} 44.0

L_{eq} 60.5

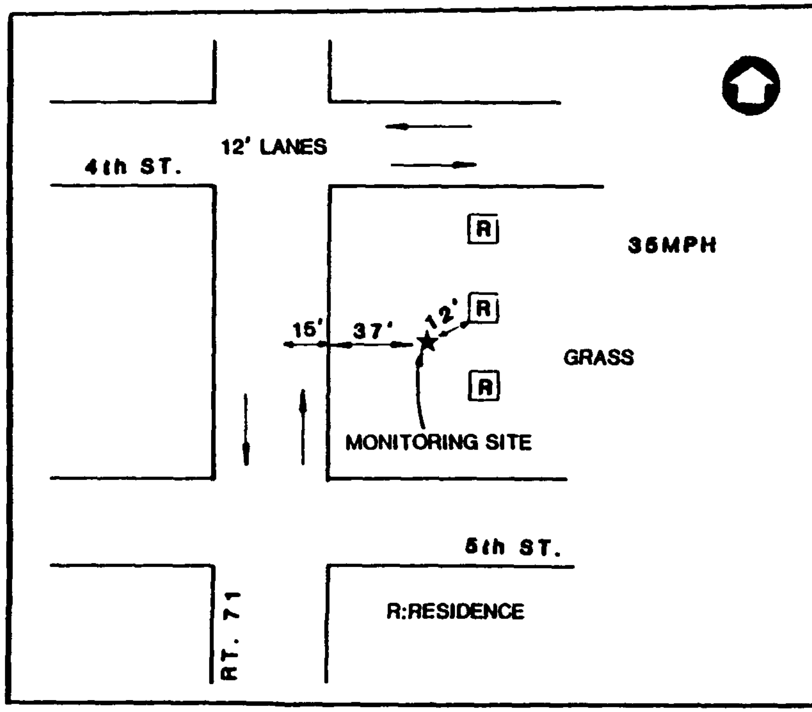
Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.7
8-10	5.1
10-12	9.2
12-14	10.6
14-16	11.9
16-18	10.3
18-20	10.6
20-22	10.6
22-24	10.4
24-26	7.6
26-28	4.0
28-30	2.3
30-32	1.6
32-34	1.0
34-36	0.8
36-38	0.3
38-40	0.1
40-42	0.1
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

NUMBER 15

Project No. EX 299 Location: KIMBALL, ROUTE 71 Observer(s): MINNICINO, BURACK

Site No. U68 Date: 7/1/83 Day: S M T W Th (F) S Time Period: 4:15-5:15 AM/(PM)



Checklist

Receptor
- o Distance o Surface
- o Elevation o Address

Roadways
- o Width o Shoulders
- o No. Lanes o Speeds
- o Surface o Stop Signs
- o Signals o Bus Stops

Note: Use back of sheet to show more details as necessary

Wind Speed/Dir: 4 MPH±/SW
Temp/Rel Hum: 84°F/36%
General Weather: MOSTLY CLEAR
No. Samples: 18,000
Sample Period: 0.2 SEC
Range: 36-100 Response: FAST/INST.
Batt Before/After: - 6.66
Cal Before/After: 93.5 93.5
Equipment Used: B+K 4426 ANAL, B+K 2619 PREAMP, B+K 4165 MIC, B+K 4230 CALIB.
Comments: SOME FIREWORKS

Time Period: 4:15-5:15 AM/(PM)

TRAFFIC COUNT	A	B	C	D	E	F	G	H
Autos and Light Trucks	313							
Medium Trucks/Buses	17							
Heavy Trucks	25							
Motorcycles	1							
Flyovers/								

Instrument Output

L_{10} 64.0 L_{50} 55.8
L_{90} 48.3 L_{99} 43.8
L_{eq} 61.9

Noise Level Distribution (percent of time)

0-2	0.0
2-4	0.0
4-6	0.0
6-8	0.7
8-10	2.4
10-12	6.2
12-14	9.9
14-16	10.6
16-18	10.8
18-20	11.0
20-22	11.7
22-24	11.5
24-26	8.8
26-28	4.9
28-30	3.2
30-32	1.9
32-34	1.6
34-36	0.7
36-38	0.8
38-40	0.5
40-42	0.1
42-44	0.0
44-46	0.0
46-48	0.0
48-50	0.0
50-52	0.0
52-54	0.0
54-56	0.0
56-58	0.0
58-60	0.0
60-62	0.0

NUMBER 16

APPENDIX B

APPENDIX B

NOISE MODEL DESCRIPTIONS

B.1 STAMINA 2.0 Model

The Federal Highway Administration's (FHWA) STAMINA 2.0 computerized noise model has been developed to predict noise levels resulting from roadway operation of motor vehicles. The model predicts noise levels from automobiles and medium and heavy-duty trucks. STAMINA 2.0 incorporates data on vehicle volumes, speeds, the physical characteristics of the roadway under study, and the surrounding terrain in calculating noise levels. Additionally, calculations for roadway grade, barriers (reflective or absorptive), ground cover, and adjustments for noise levels as they may vary over distance are components of this model.

The program describes a roadway by the traffic flow conditions defined for the roadway. Each roadway may be defined by a maximum number of five different traffic flow conditions (based on a combination of vehicle type and speed). The model allows a maximum number of 30 roadways to be defined. Roadways may intersect or coincide geometrically. The alignment of each roadway is defined by a connected series of straight line roadway segments oriented on a Cartesian coordinate system. For upgrade roadway segments, heavy truck noise emissions may be increased to approximate typical operational characteristics.

STAMINA 2.0 considers only the most effective diffraction of sound from a subsegment of a roadway segment to a receiver for source-receiver paths containing multiple diffractions (i.e., barriers). Shrubbery, trees, and buildings are handled as optional user-defined shielding factors for each roadway-receiver pair.

Typical model output consists of the following parameters:

- Receiver number, the X,Y,Z coordinates of the receiver, and the receiver title;
- A-weighted octave band sound levels;
- A-weighted sound level metrics:
  - The overall A-weighted equivalent sound level (L_{eq});
  - The overall A-weighted sound level exceeded 90 percent of the time (L_{90});
  - The overall A-weighted sound level exceeded 50 percent of the time (L_{50});
  - The overall A-weighted sound level exceeded 10 percent of the time (L_{10}); and
  - The estimated standard deviation of the sound level variation.

B.2 FAA Airport Noise Exposure Contouring Procedure

Noise levels for the Cheyenne Airport were evaluated using a Federal Aviation Administration (FAA) airport noise exposure contouring procedure developed by Bolt, Beranek and Newman, Inc. in 1975 and updated in 1982. This procedure was used primarily as a screening methodology to determine generic impacts and the subsequent need for more detailed analysis.

The FAA procedure allows the analysis of three measures of aircraft/airport noise exposure levels:

- o Composite Noise Rating (CNR);
- o Noise Exposure Forecast (NEF); and
- o Day/night average sound level (L_{dn}).

The CNR and NEF have been widely used in developing contours for both military and civil airports. The L_{dn} is increasingly used for depicting the noise exposure at both civil and military airports and has been used in the preparation of noise level contours for Cheyenne Airport in this study.

The noise exposure expressed in terms of CNR, NEF, or L_{dn} is the summation of the noise contributed by individual events, with the summation (or integration) extending over a typical 24-hour period of operations at the airport. By defining the noise around the airport for each typical airport operation, a set of noise exposure contours for varying numbers of these typical operations on a runway can be developed. These contours then would be applicable to a wide range of general aviation airports because the many noise elements of aircraft operations are similar regardless of airport size. Thus, sets of noise exposure contours which are selected on the basis of the number of operations on a runway can be utilized.

The FAA procedure provides the necessary guidelines for selecting the appropriate noise exposure contour and for making adjustments to the contours, as needed, to have them fit the operation at a specific airport. Because of major differences in both noise output and mode of operation between propeller aircraft and the often much noisier business jet aircraft, separate sets of noise exposure contours are presented for propeller aircraft and business jet operations. Where both types of aircraft operate from the same runway, two sets of noise exposure contours are combined.

The basic noise exposure contours presentation is in terms of operations from a single runway, allowing for differing proportions of operations in either direction. Contours are developed for separate runways, and where runways are adjacent or intersecting, the noise contours are combined as appropriate.

In summary, the four major steps in developing the noise exposure contours are as follows:

- Obtain airport and aircraft operational information;
- Determine the adjusted number of operations for propeller aircraft and for business jet aircraft;
- Select the basic noise exposure contours; and
- Adjust and combine the basic noise exposure contours.

The following information is needed in order to effectively use the model:

- Total annual operations (jets);
- Total annual operations (propeller);
- Left or right hand traffic pattern;
- Runway utilization;
- Runway length;
- Percentage of propeller operations between 10:00 PM and 7:00 AM;
- Percentage of jet operations between 10:00 PM and 7:00 AM;
- Twin engine operations as percentage of all propeller operations;
- Turbojet operations as percentage of all jet operations;
- Number of jet operations per year on a given runway;
- Number of propeller operations per year on a given runway;
- Optional adjustment for larger aircraft; and
- Runway utilization for each runway.

B.3 Wyle Laboratories Railroad Noise Procedure

The Wyle Laboratories procedure is a hand-calculation technique for assessing railroad operation noise environments. The model, based on empirical derivations, is split into two separate sections: line operations and railroad yard operations. Mean-maximum noise levels along with duration terms are incorporated into the analysis for conservative results.

Line operations is the term applied principally to operation of freight trains over mainline track and local branch mainlines. Only operations involving diesel-electric locomotives (which comprise 99 percent of the engine fleet) and freight cars are considered in the model.

The analysis of line operations considers the two major contributions responsible for noise generation: the road power (diesel-electric locomotives in combination) and the car-generated noise levels (wheel/rail interaction). Field measurements are in the form of A-weighted pass-by time histories at a specified standard reference distance perpendicular to the centerline of the track (generally 100 feet). Where appropriate, these time histories are supplemented by one-third octave band frequency spectra of significant events. The noise emitted by safety warning devices, in particular locomotive horns and crossing bells, is not included in the model.

Only operations conducted within the confines of yard property boundaries are considered for railroad yard operations. The majority of yard operations considered are associated with the classification of freight cars in the yard complex and services related to performance testing and routine maintenance of locomotives. Additionally, noise emitted by stationary idling road engines and mechanical refrigeration cars are included. These operations may occur outside the yard boundary on sidings and spur tracks located throughout the surrounding community.

The analysis of railroad noise first considers the physical operation of a classification yard and defines those specific elements of the operation which are considered to influence the composite noise impact of the facility. These contributing elements are then individually analyzed and the characteristics of the noise emitted by each presented. The noise levels emitted by individual yard operations will be expressed in terms of A-weighted sound pressure level. Since the spread of noise levels from these individual operations may easily encompass a band of 10 to 15 dB variation, the philosophy has been adopted to select representative levels from the upper limits of the data for projection into the community. These levels will be termed the "mean-maximum" quantities as determined by the statistical mean of the observed data plus one standard deviation.

Noise emitted by freight trains depends not only upon the operational mode of the train but its physical makeup and the properties of the track and local terrain. The train pass-by may be ideally described as the combination of two distinct elements: noise emitted by locomotives and noise emitted by freight cars. The individual contributions of the engine and cars are clearly discernible. To achieve the program goals, it is necessary to analyze both the locomotive and the freight car elements of this pass-by time history, and develop a suitable method of synthesizing train time histories given a number of basic parameters.

The characteristics of the noise emitted by line operations have been discussed primarily in terms of maximum A-weighted noise levels. The California Code No. 65302 recommends not only that A-weighted levels be used to describe the magnitude of the noise but that, in addition, corrections be added to reflect the duration of each event and the total number of occurrences per 24-hour period. Hence, it is necessary to introduce the concept of duration-corrected intrusive noise events. This concept has been used to develop the L_{dn} values reported.

The significant noise producing operations and the operational modes of the equipment involved, as evaluated with this model, are summarized as follows:

Locomotives - Road and Switcher

- Switcher engine operations including road engines pulling trains through the yard:

  - uniform pull or shove;

  - braking; and

  - acceleration.

- Idling road and switcher engines (singly or in groups of up to 25 or more).

Car Impacts

- Single or multiple cars into standing cars - coupling; and

- Chain reaction (slack action) impacts - start-up or stopping of a line of cars.

Car Retarders

- Master retarder;

- Group retarders or individual track retarders; and

- Inert or pull-out retarders.

Loudspeakers and Public Address Systems

Auxiliary Service Operations Performed in Yards

- Engine load tests;

- Locomotive service racks and shop facilities; and

- Operation of stationary mechanical refrigeration cars.

APPENDIX C
NOISE LEVEL CONTOUR GRAPHICS

C.1 Introduction

The 65-L_{eq} noise level contour, based on estimates calculated by the STAMINA 2.0 computer model have been plotted on October 1, 1981, aerial photographs of Cheyenne.

The original 1:2,000 scale photographs were acquired from the Wyoming State Highway Department. These photographs were blown up to a 1:500 scale for contour-plotting and presentation purposes. A listing of the Figure numbers and titles follow.

C-41 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, NORTH OF DELL RANGE BOULEVARD

C-42 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, THOMAS ROAD TO GLENCOE DRIVE

C-43 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD SOUTH OF FOUR MILE ROAD

C-44 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, EVANS AVENUE, EIGHTH AVENUE TO PERSHING BOULEVARD

C-45 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, FOUR MILE ROAD TO EVERGREEN STREET

C-46 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, EVERGREEN STREET TO CENTRAL AVENUE RAMPS

C-47 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, CENTRAL AVENUE TO FRONTIER PARK

C-48 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, FRONTIER PARK TO PERSHING BOULEVARD

C-49 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, PERSHING BOULEVARD TO MISSILE DRIVE

C-50 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, MISSILE DRIVE TO U.S. 30 RAMPS

C-51 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PRAIRIE AVENUE, YELLOWSTONE ROAD TO MYLAR PARK

C-52 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, DELL RANGE BOULEVARD, MYLAR PARK TO POWDER HOUSE ROAD

C-53 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, I-25 TO YELLOWSTONE ROAD

C-54 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, YELLOWSTONE ROAD TO EIGHTH AVENUE

C-83 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, RIDGE ROAD TO U.S. 30

C-84 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, COLLEGE DRIVE, BETWEEN PARSLEY BOULEVARD AND WALTERSCHEID BOULEVARD

C-85 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR DELL RANGE BOULEVARD

C-86 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR PERSHING BOULEVARD

C-87 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, NORTH OF DELL RANGE BOULEVARD

C-88 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, THOMAS ROAD TO GLENCOE DRIVE

C-89 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, SOUTH OF FOUR MILE ROAD

C-90 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, LINCOLNWAY, MORRIE AVENUE TO LOGAN AVENUE

C-91 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, EVANS AVENUE, EIGHTH AVENUE TO PERSHING BOULEVARD

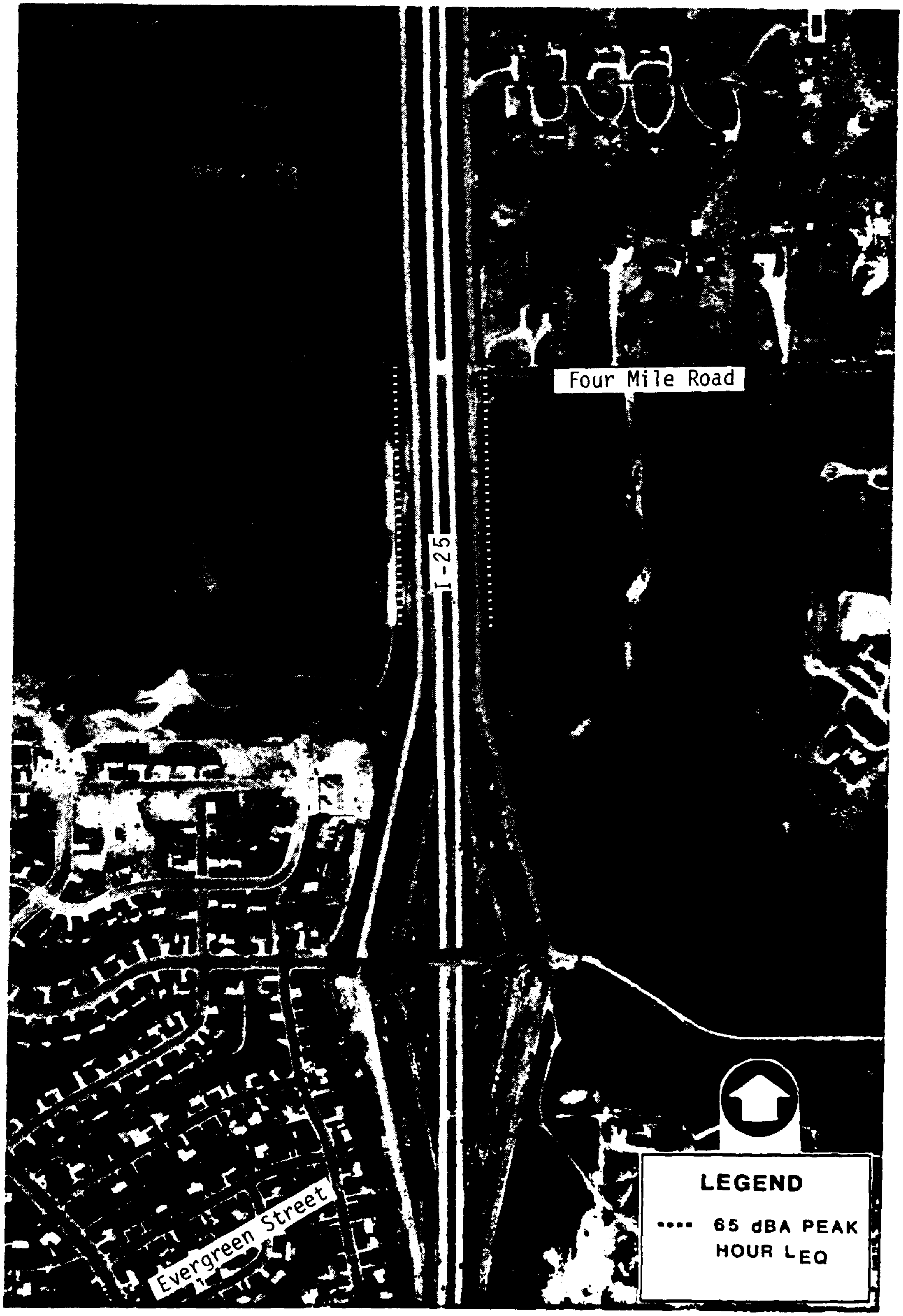


FIGURE C-1 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, FOUR MILE ROAD TO EVERGREEN STREET

FIGURE C-2 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, EVERGREEN STREET TO CENTRAL AVENUE RAMPS

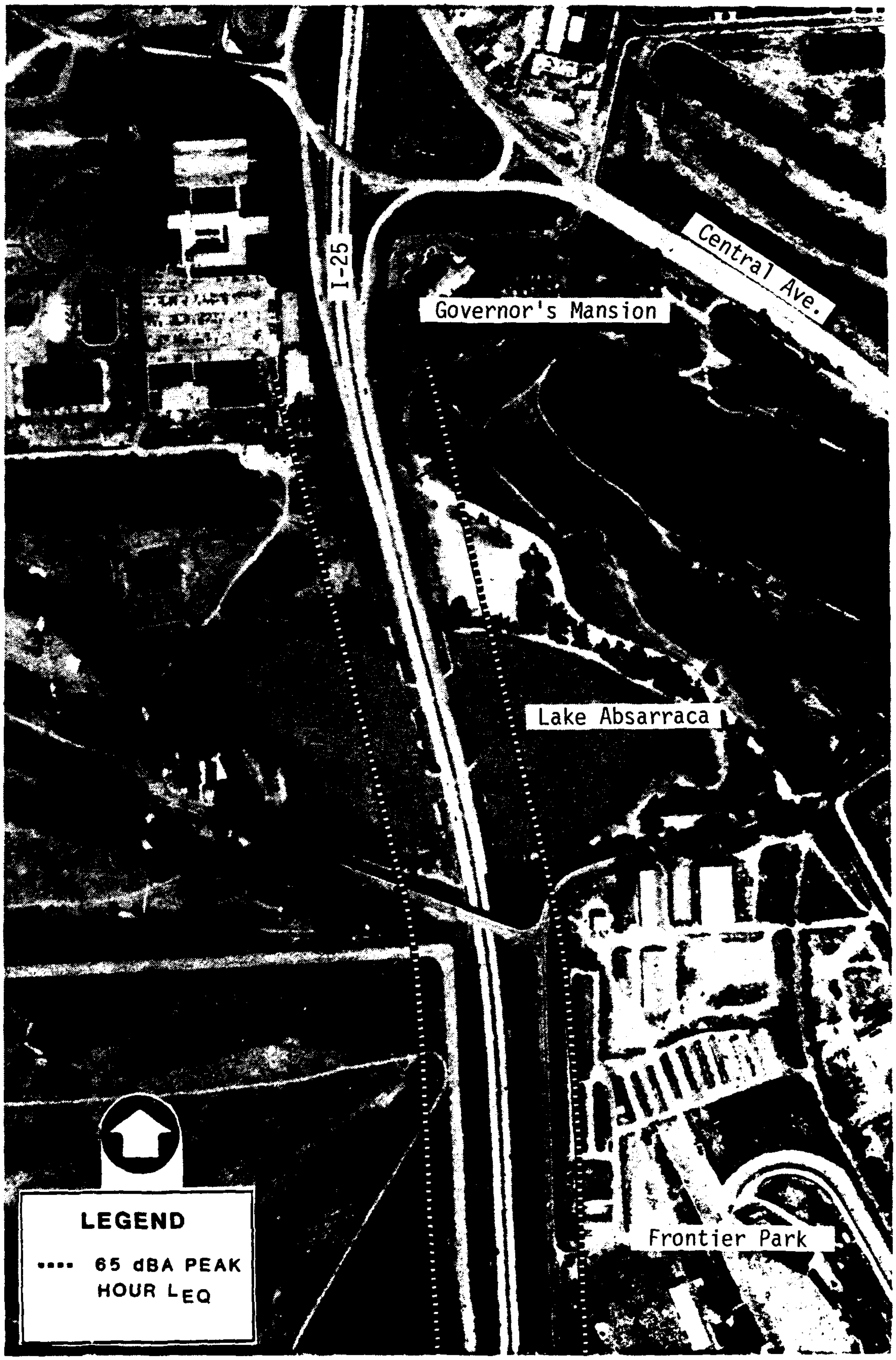


FIGURE C-3 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, CENTRAL AVENUE TO FRONTIER PARK

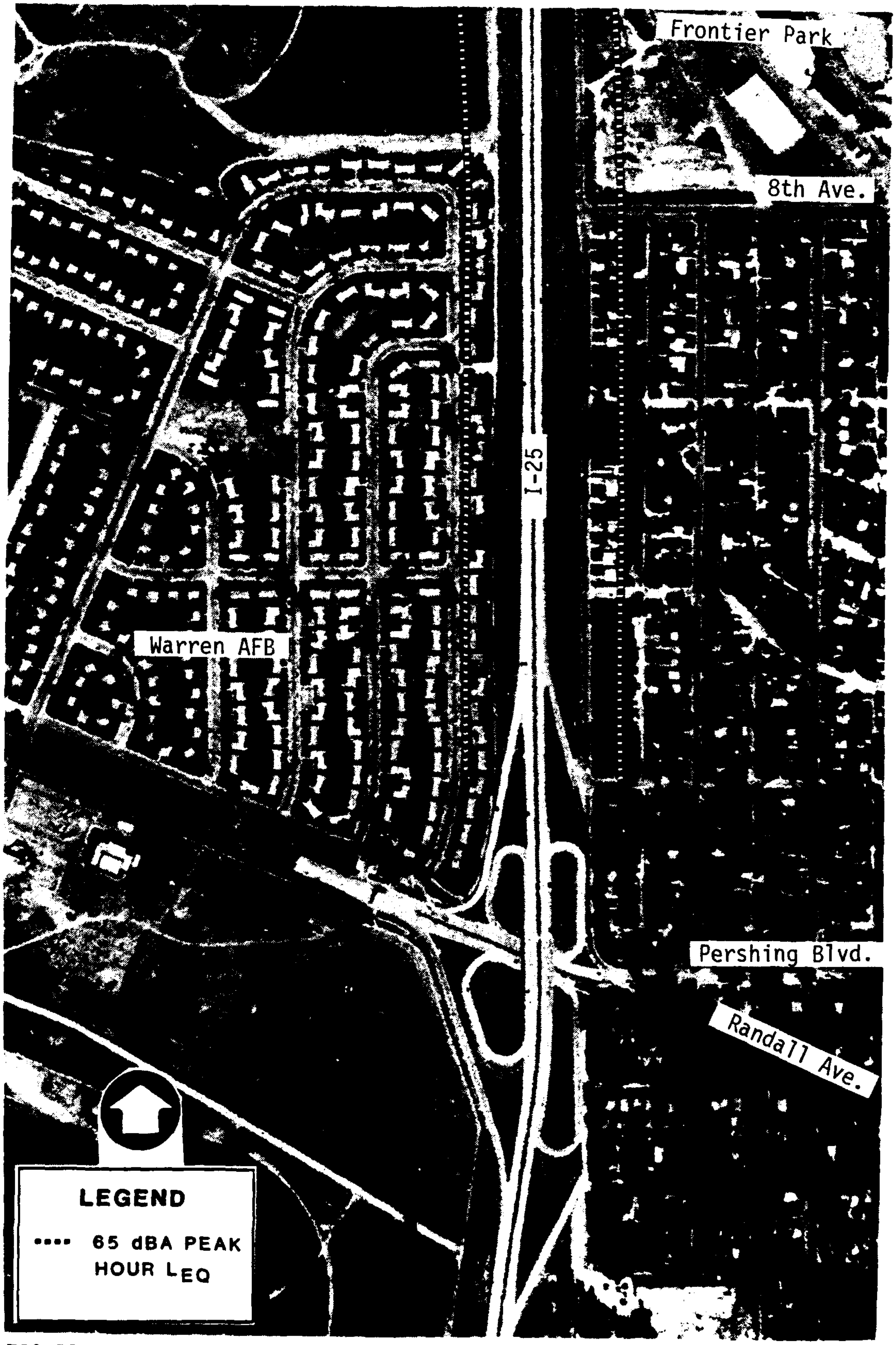


FIGURE C-4 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, FRONTIER PARK TO PERSHING BOULEVARD

FIGURE C-5 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, PERSHING BOULEVARD TO MISSILE DRIVE

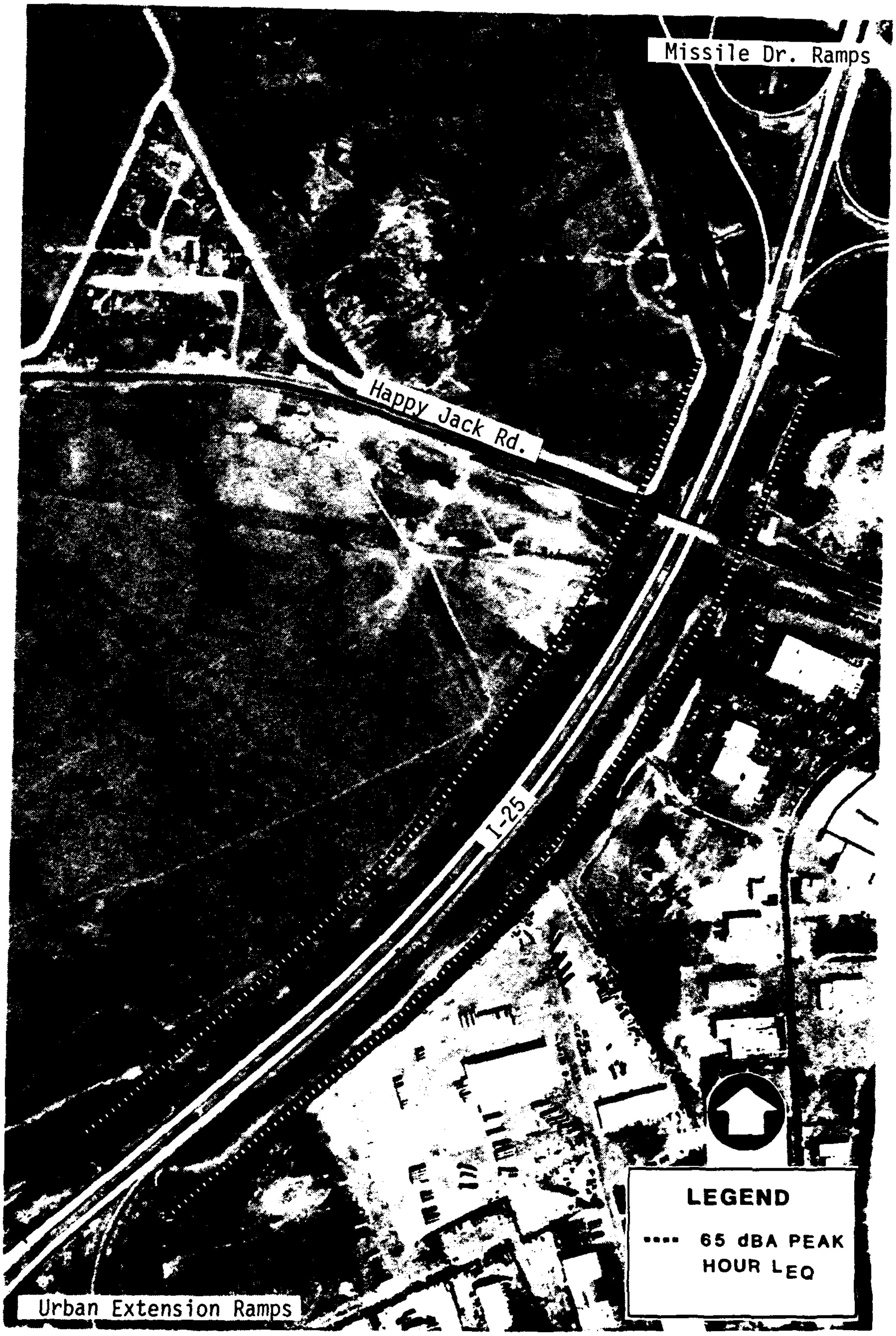


FIGURE C-6 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, MISSILE DRIVE TO U.S.30 RAMPS

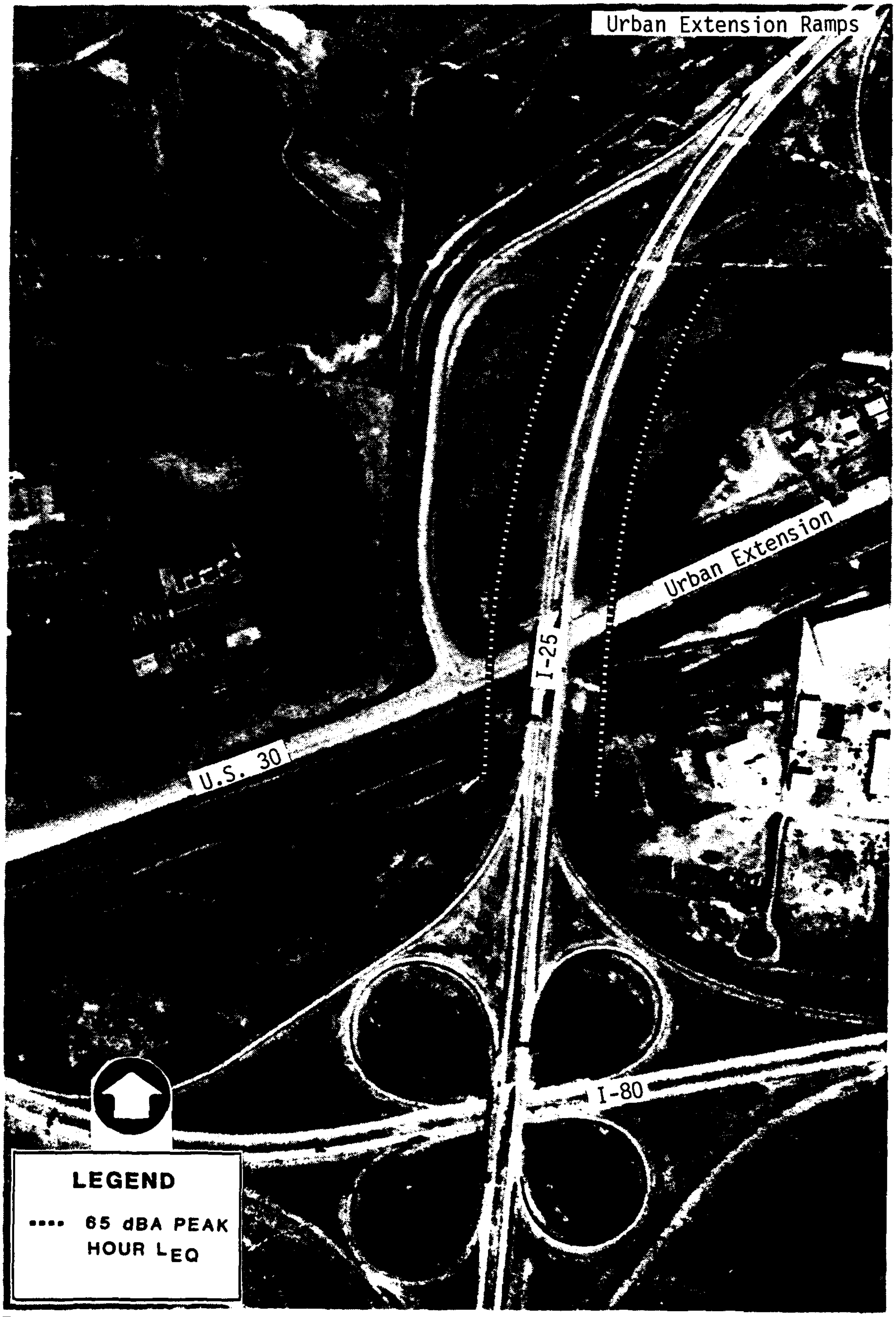


FIGURE C-7 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, U.S.30 RAMPS TO I-80

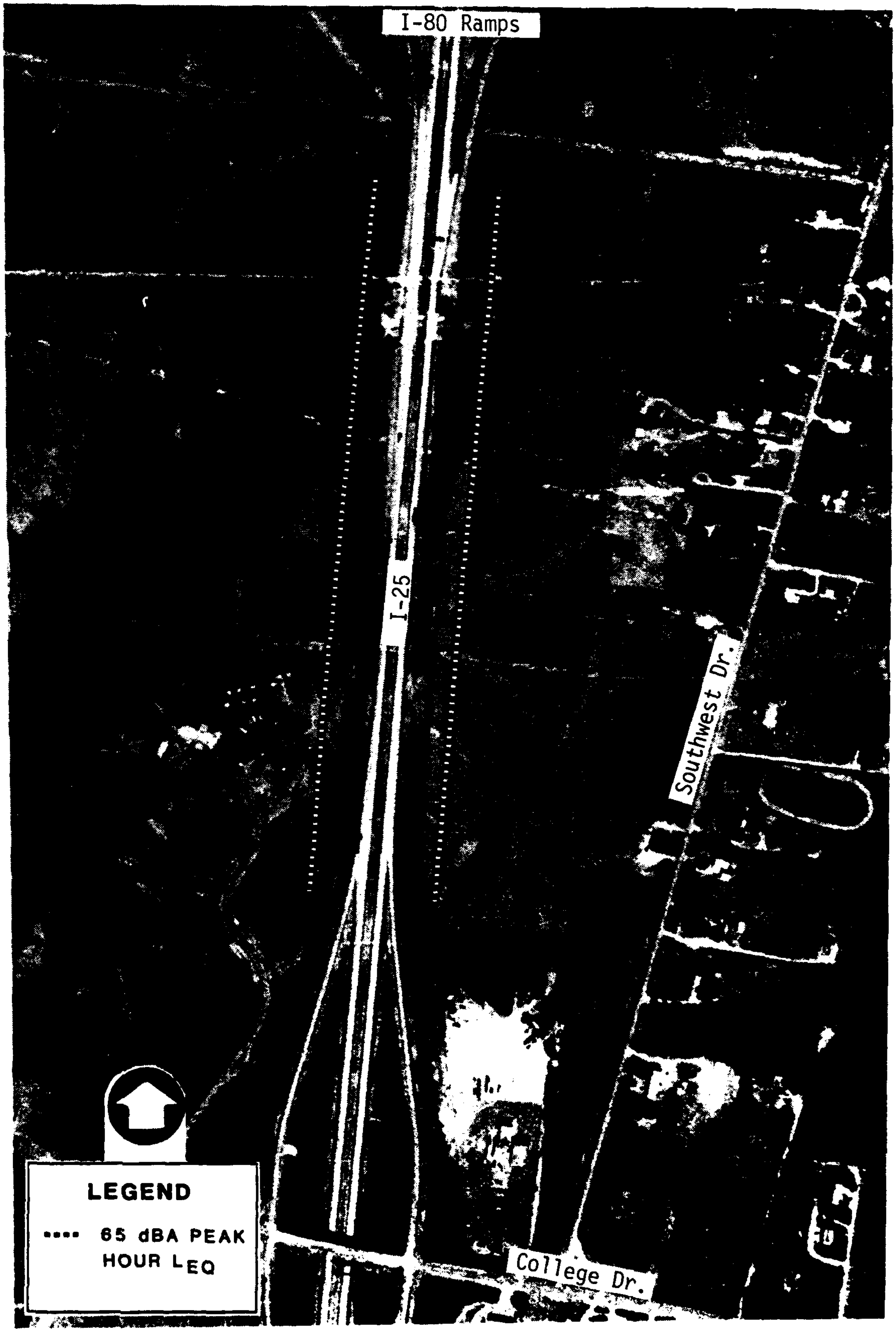


FIGURE C-8 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-25, I-80 TO COLLEGE DRIVE

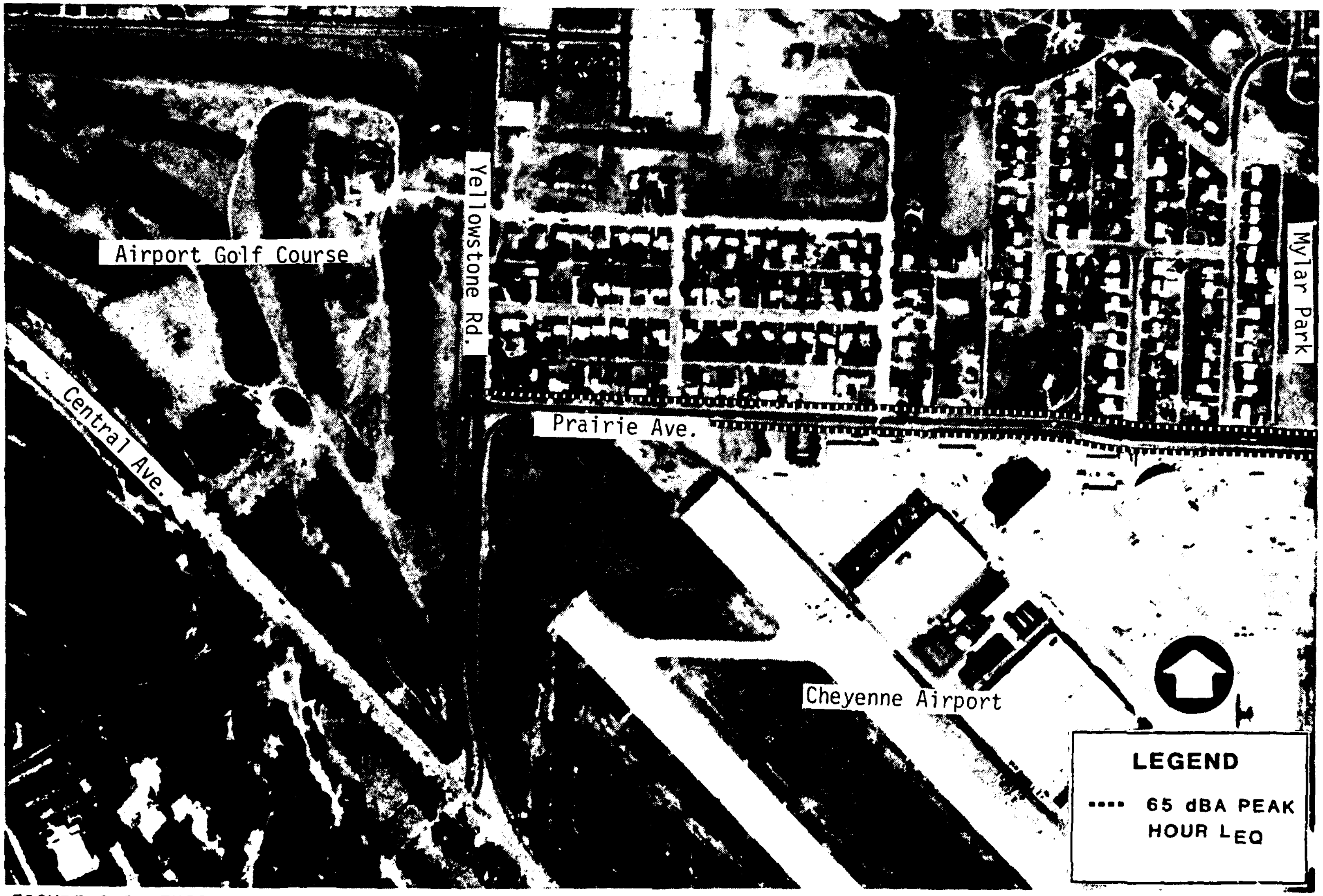


FIGURE C-9 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, PRAIRIE AVENUE, YELLOWSTONE ROAD TO MYLAR PARK

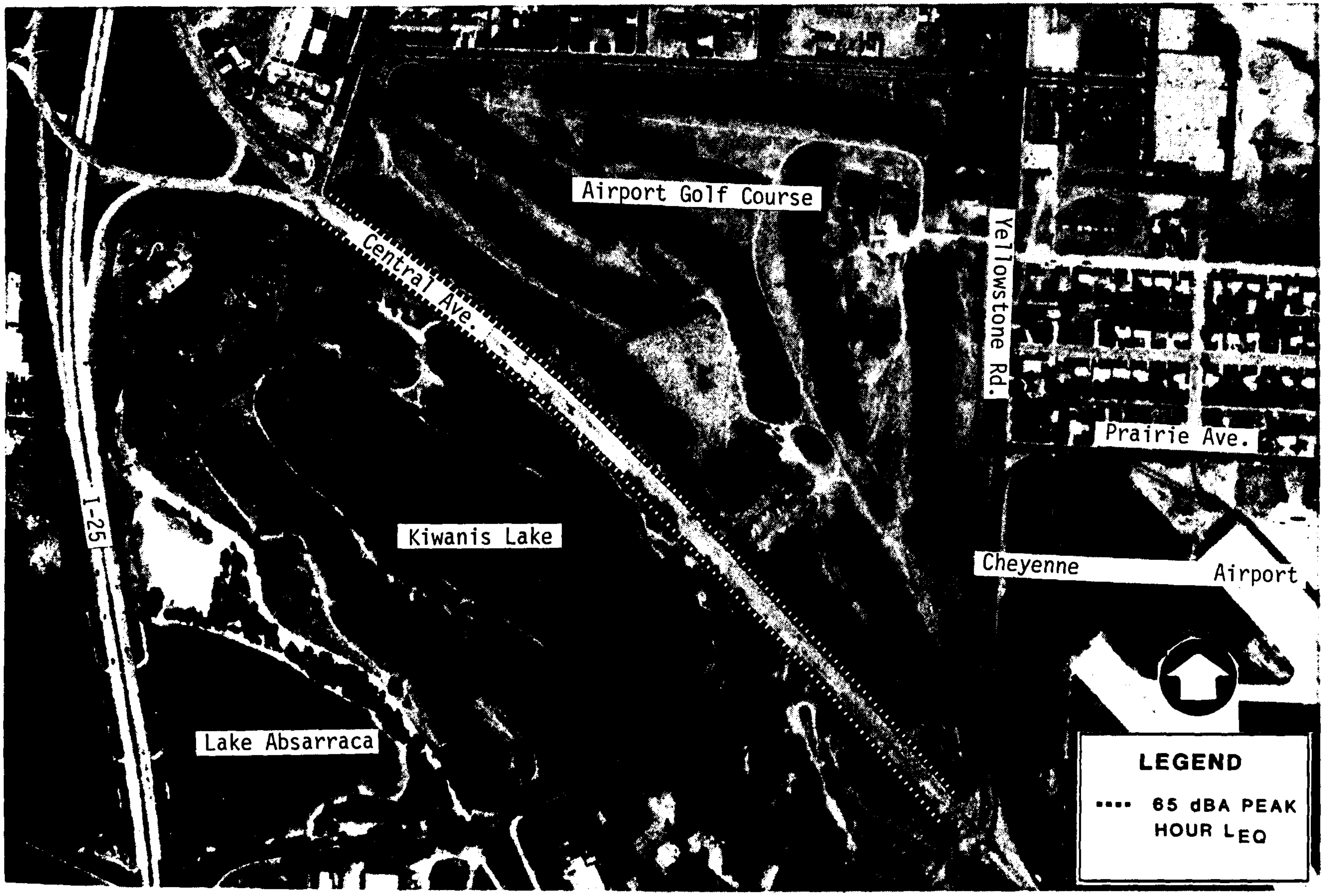


FIGURE C-10 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, I-25 TO YELLOWSTONE ROAD

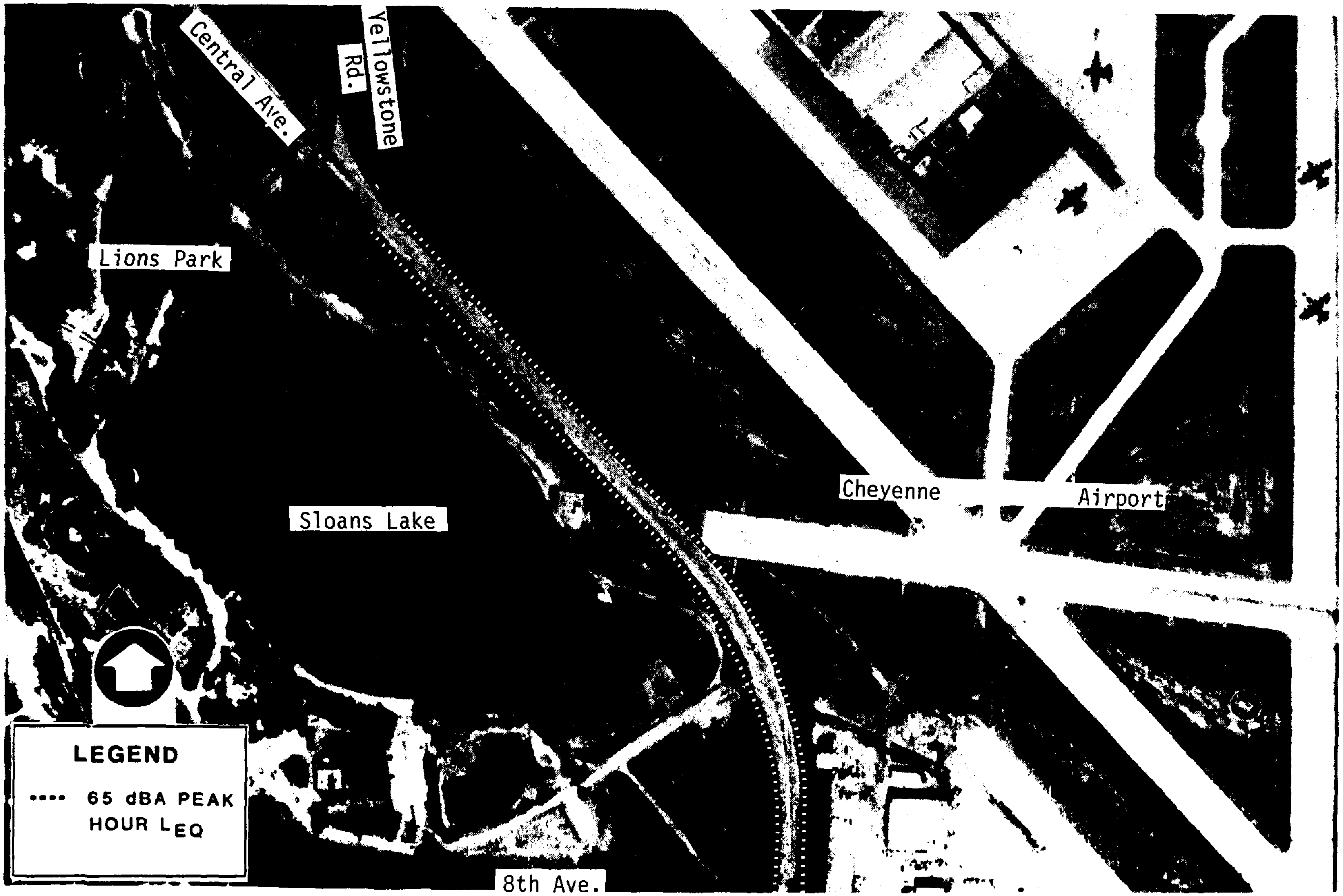


FIGURE C-11 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, YELLOWSTONE ROAD TO EIGHTH AVENUE

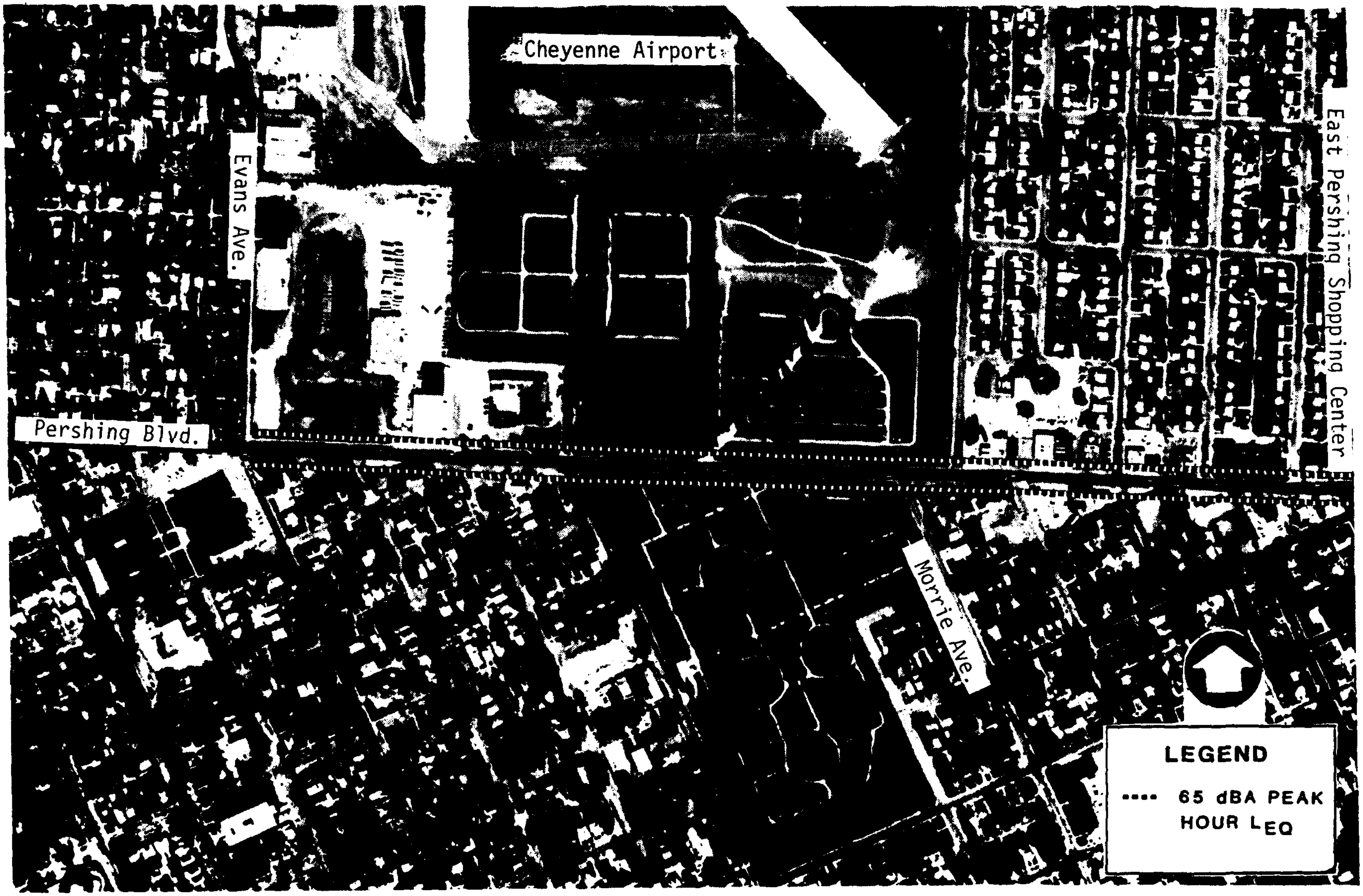


FIGURE C-12 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EVANS AVENUE TO EAST PERSHING SHOPPING CENTER

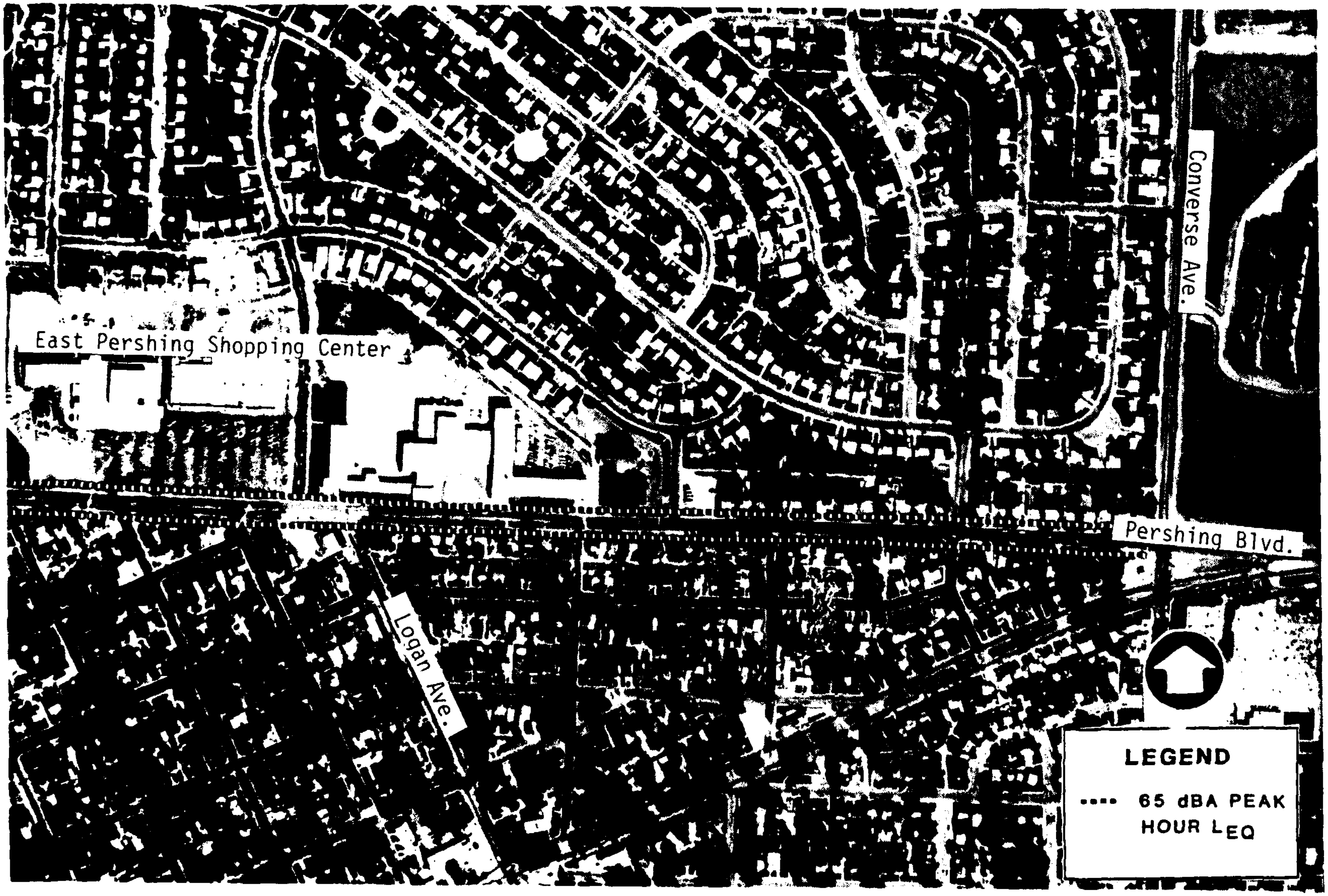


FIGURE C-13 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST PERSHING SHOPPING CENTER TO CONVERSE AVENUE

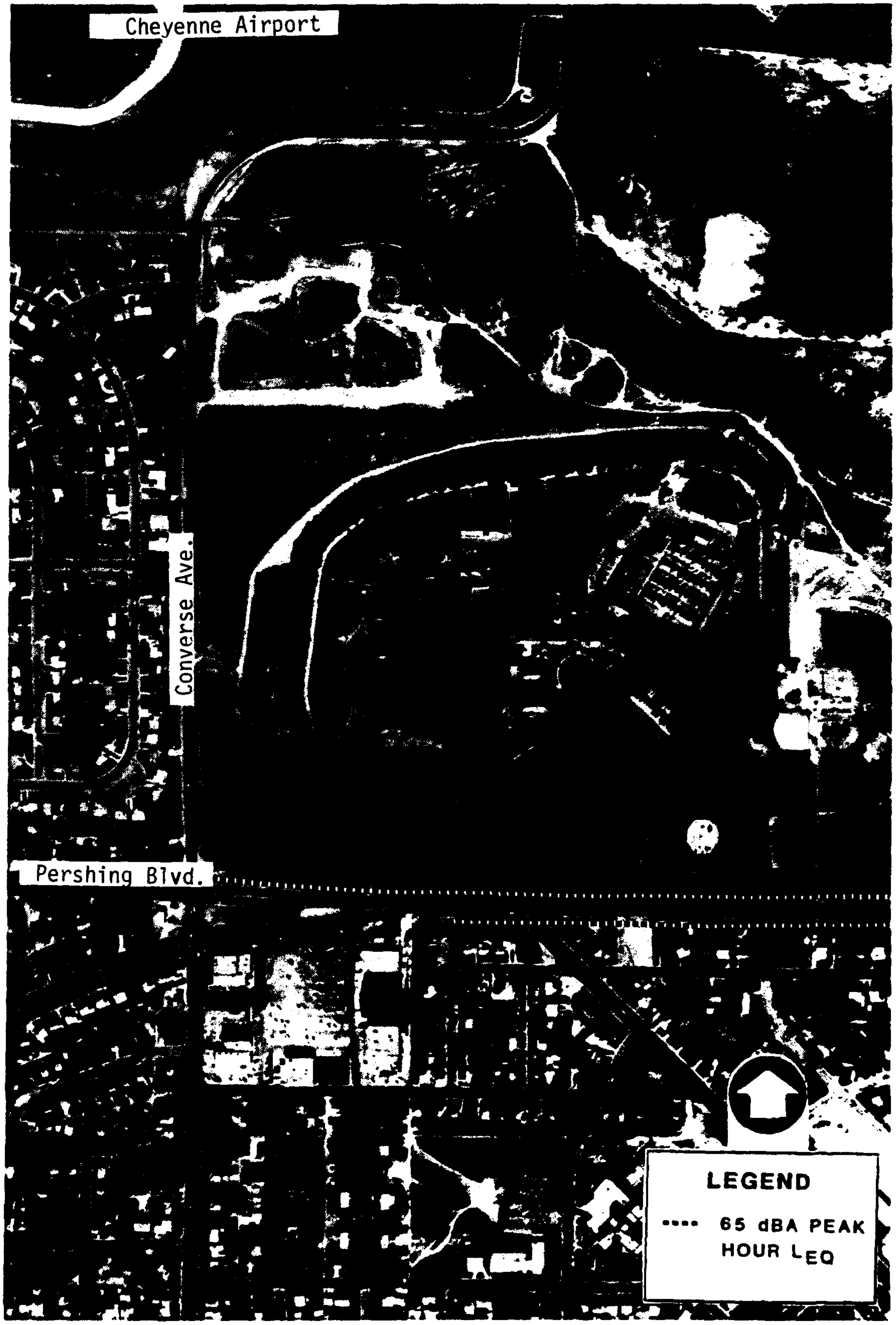


FIGURE C-14 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST OF CONVERSE AVENUE

FIGURE C-15 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, VICINITY OF WINDMILL ROAD

FIGURE C-16 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, I-25, TO RAILROAD TRACKS

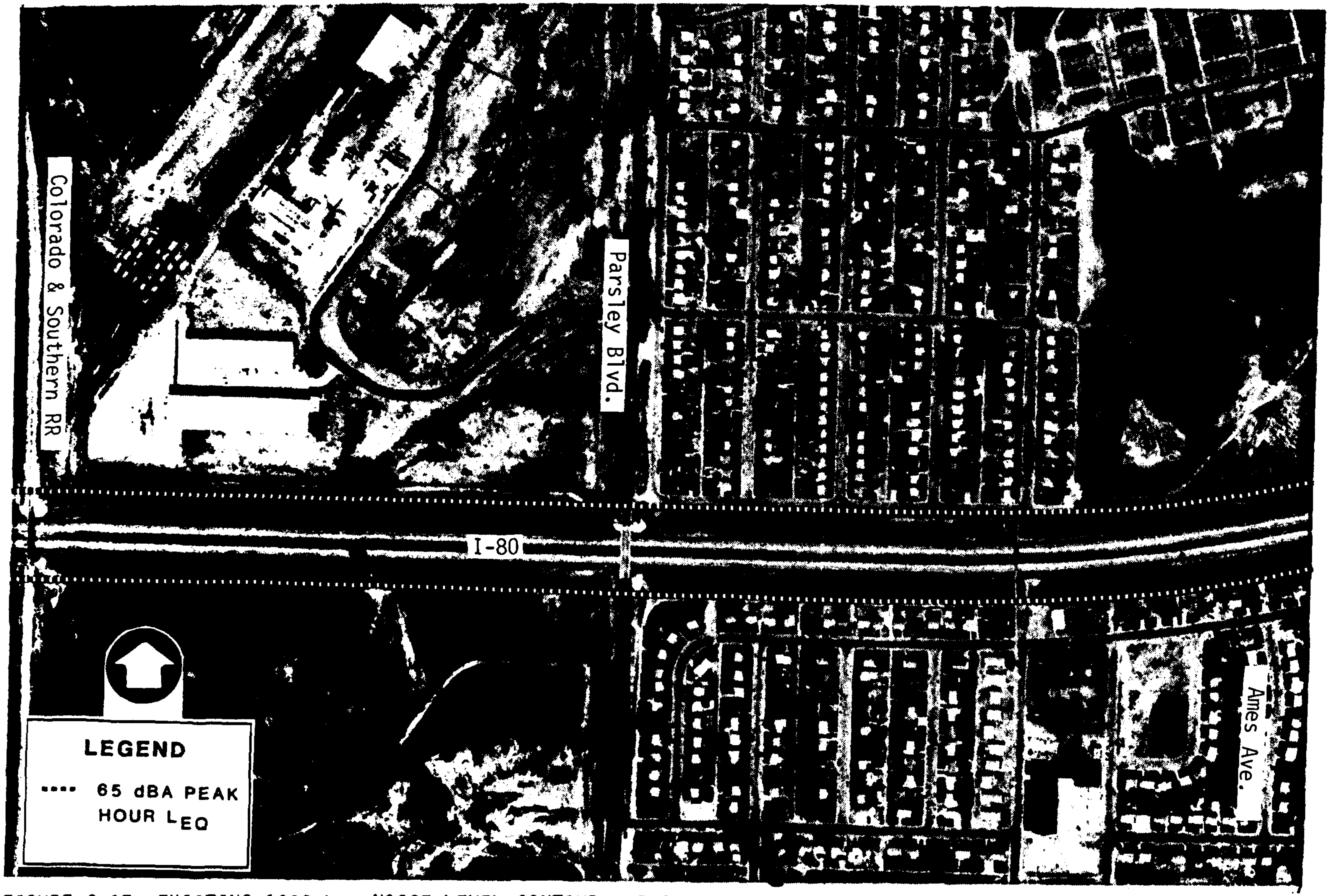


FIGURE C-17 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, COLORADO & SOUTHERN RAILROAD TO AMES AVENUE

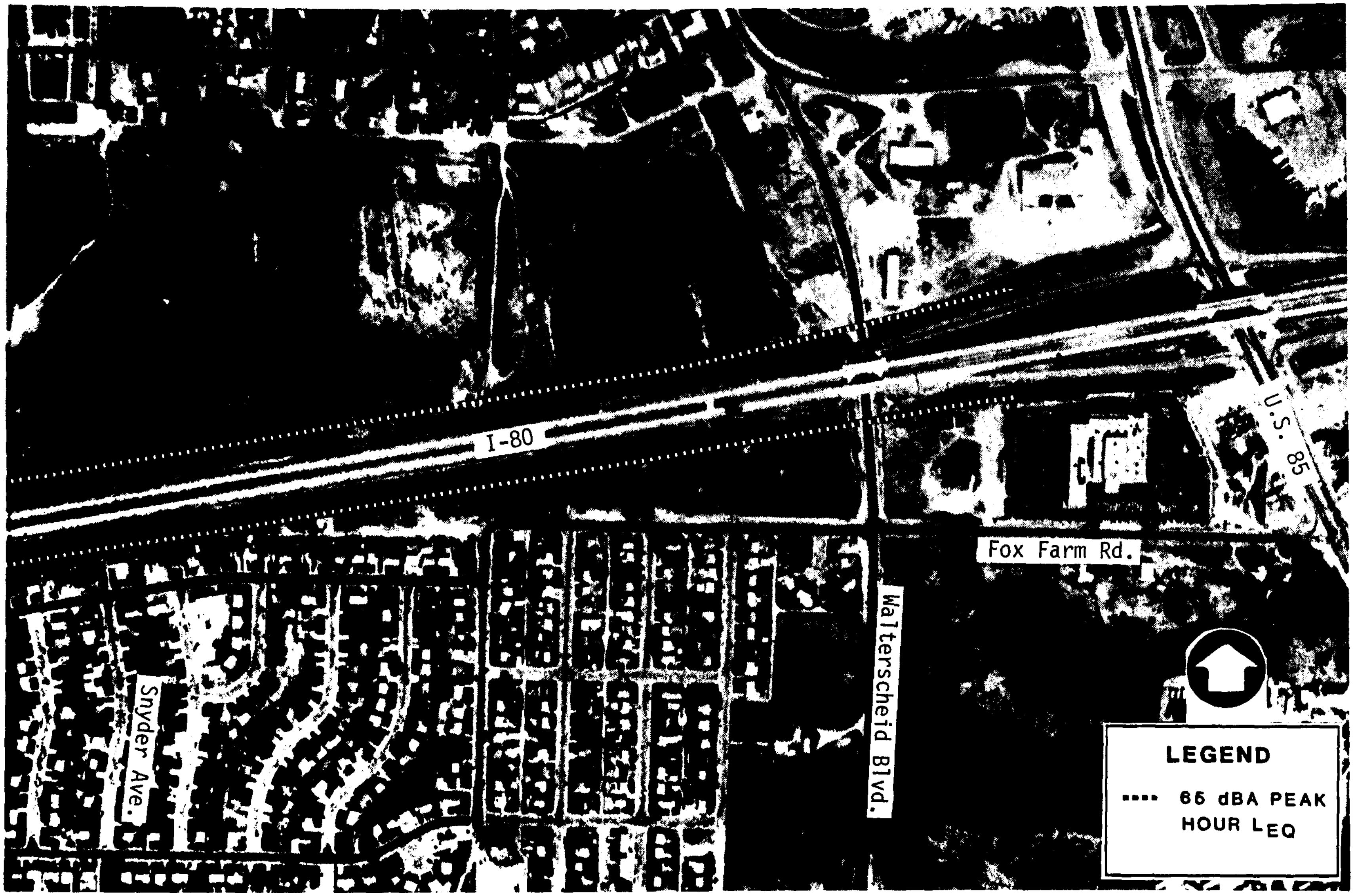


FIGURE C-18 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, AMES AVENUE TO U.S.85

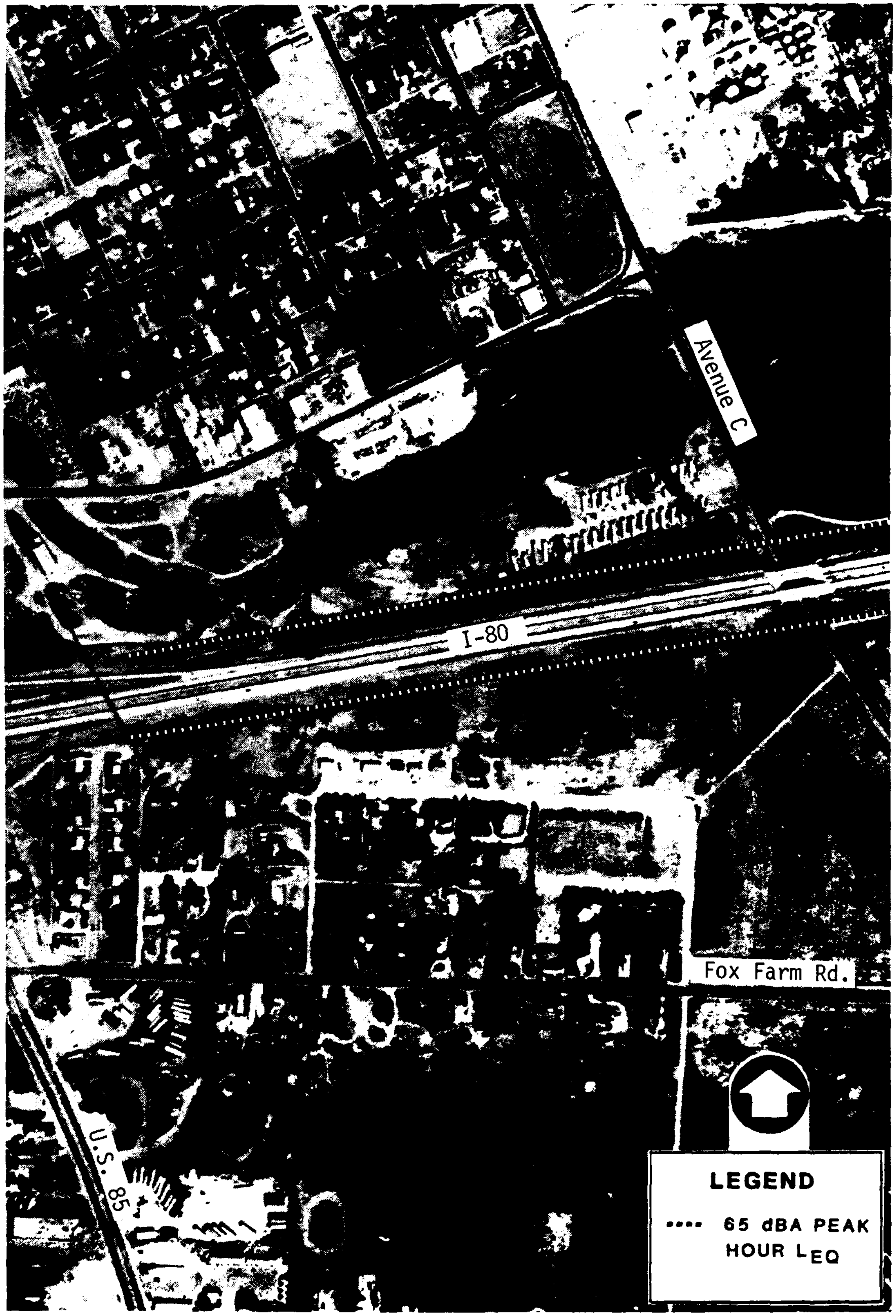


FIGURE C-19 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, U.S.85 TO AVENUE C

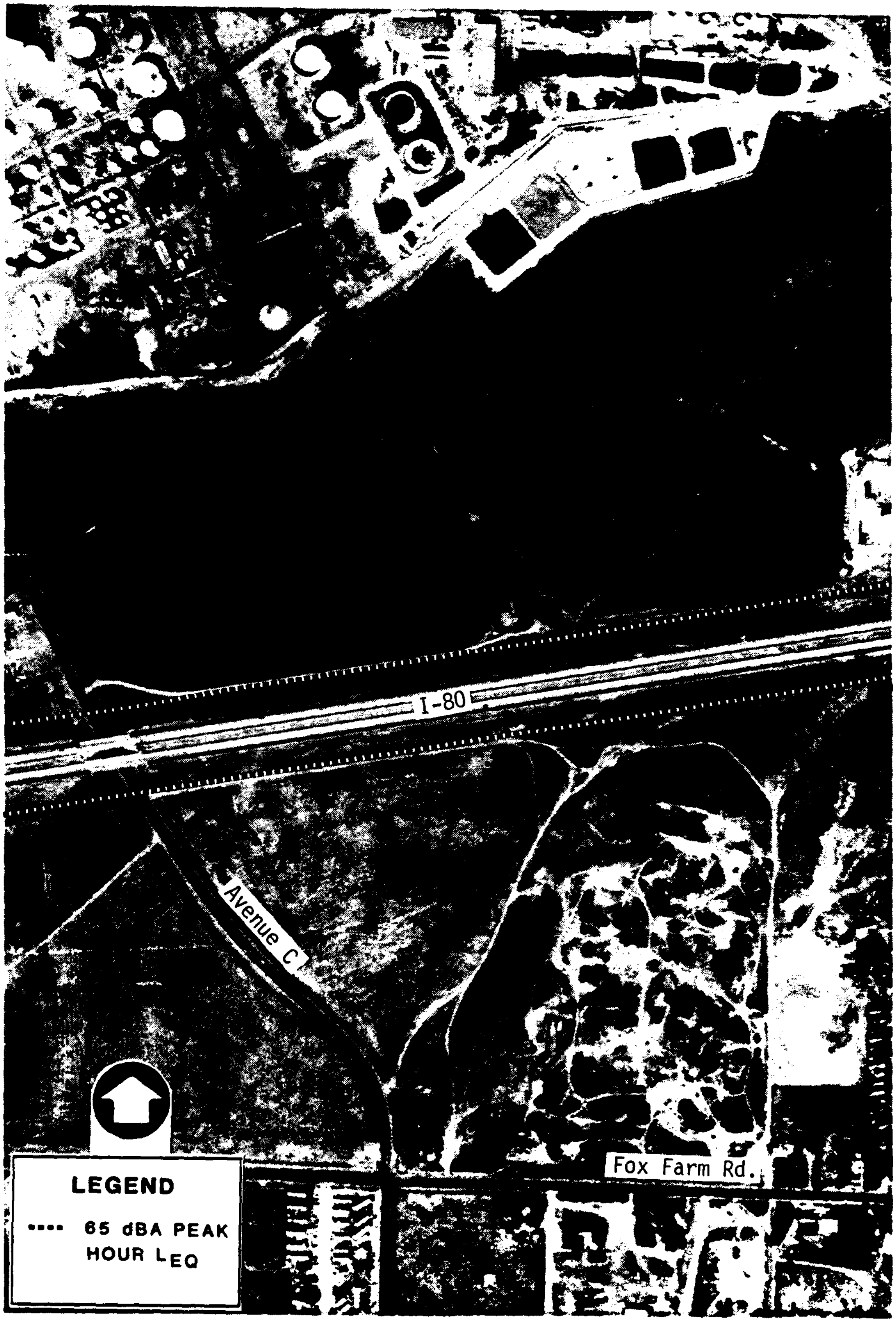


FIGURE C-20 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, AVENUE C TO OIL TANKS

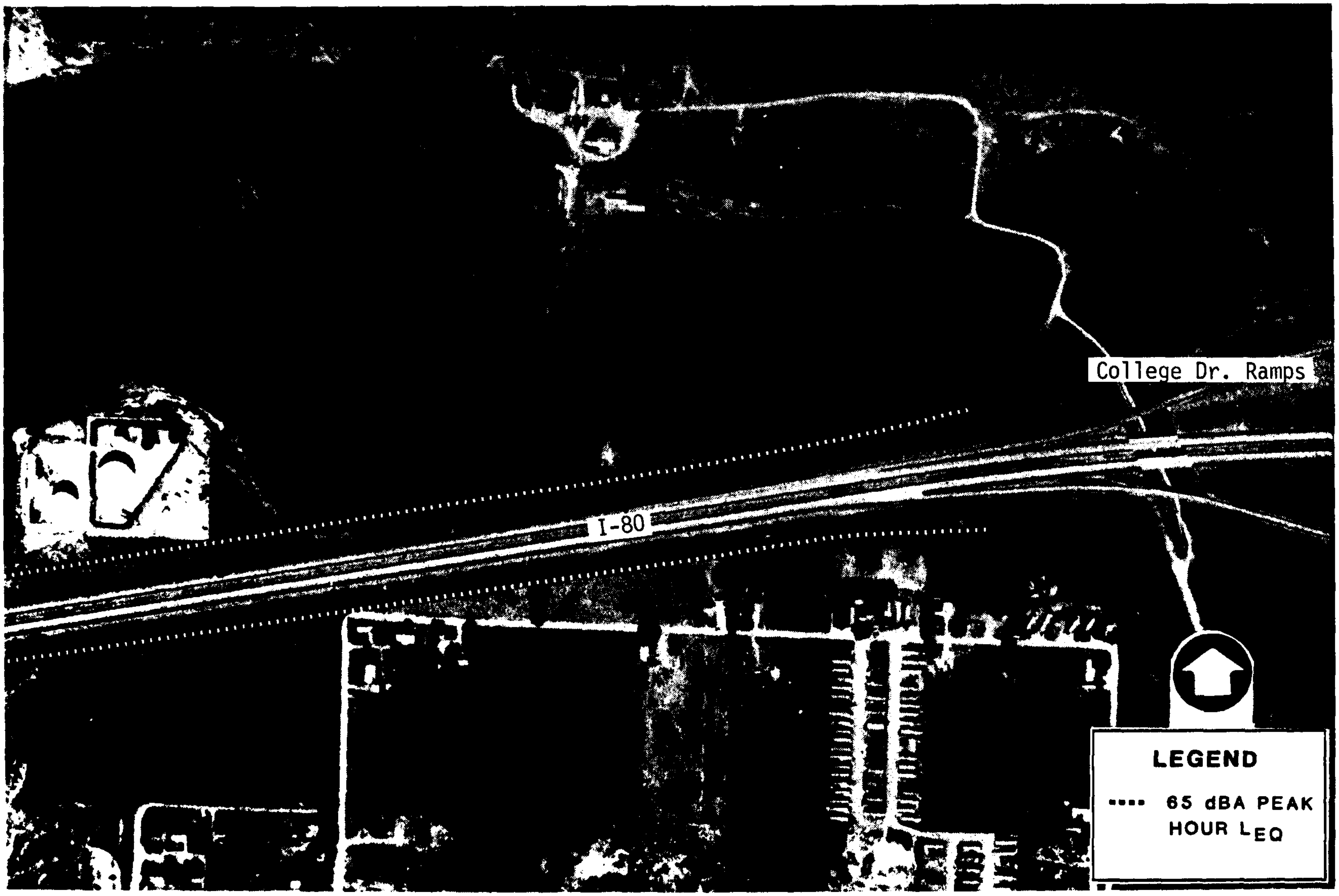


FIGURE C-21 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, I-80, OIL TANKS TO COLLEGE DRIVE RAMPS

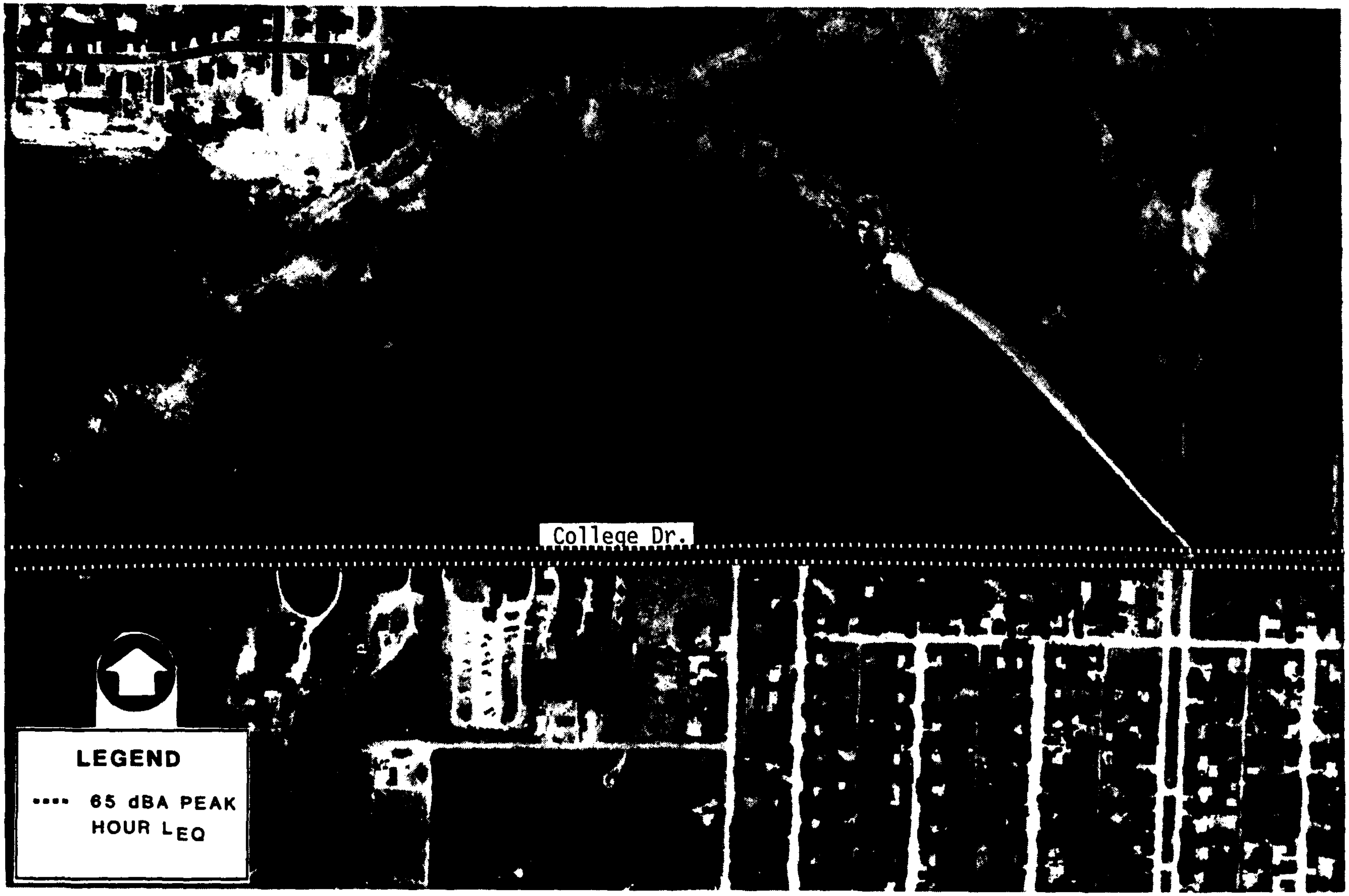


FIGURE C-22 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, COLLEGE DRIVE BETWEEN PARSLEY BOULEVARD & WALTERSCHEID BOULEVARD

FIGURE C-23 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR DELL RANGE BOULEVARD

FIGURE C-24 EXISTING 1983 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR PERSHING BOULEVARD

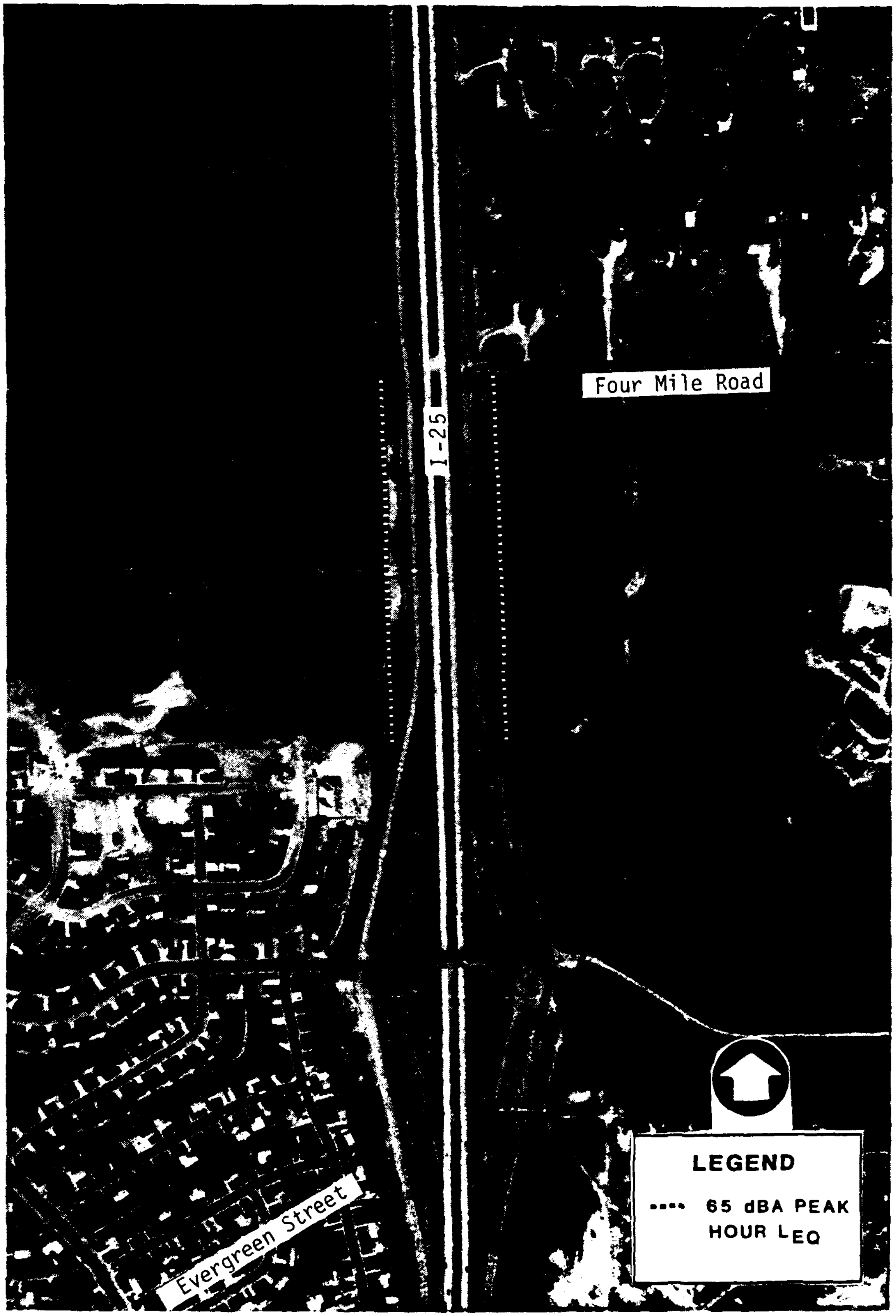


FIGURE C-25 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, FOUR MILE ROAD TO EVERGREEN STREET

FIGURE C-26 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, EVERGREEN STREET TO CENTRAL AVENUE RAMPS

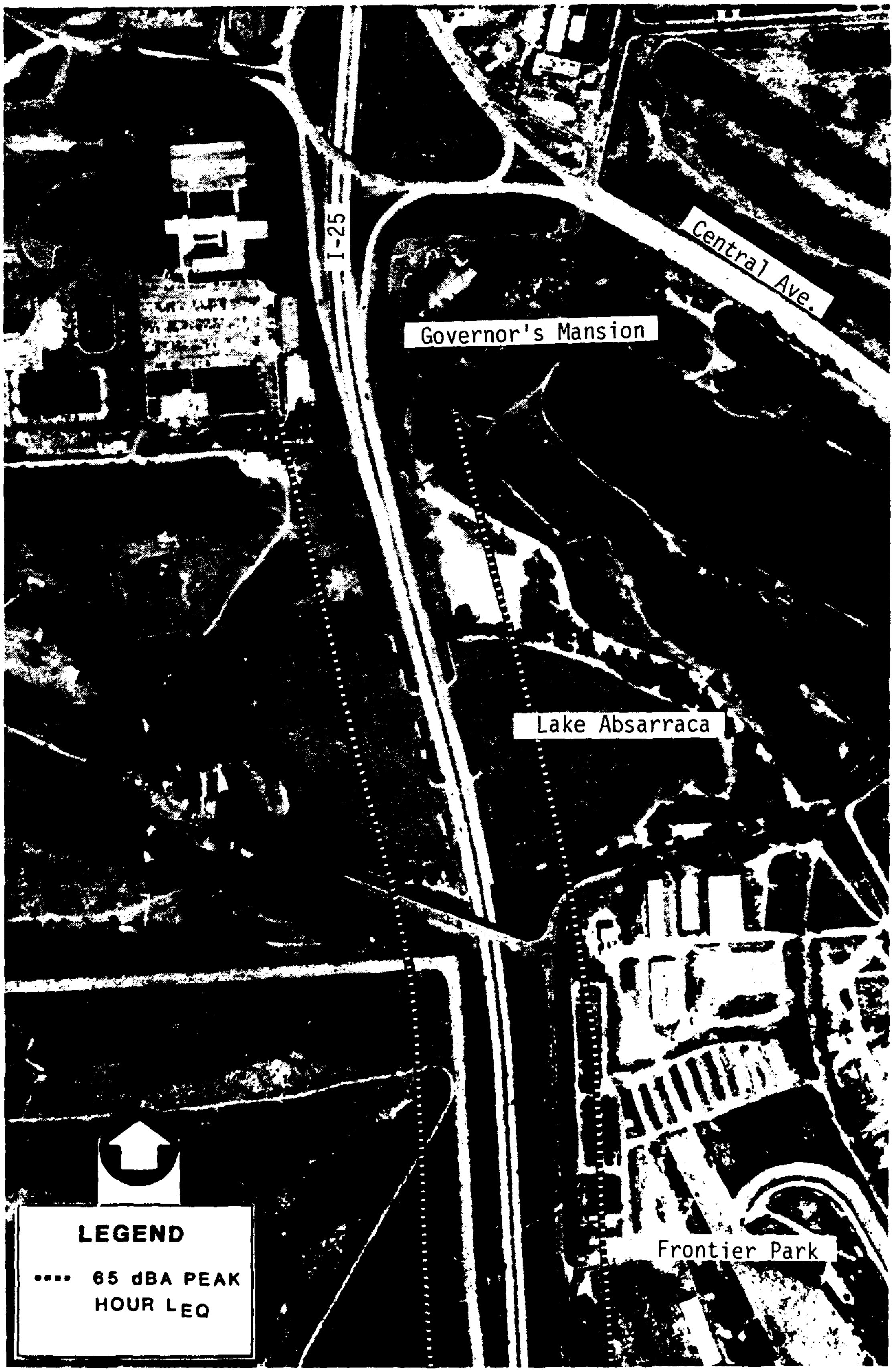


FIGURE C-27 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, CENTRAL AVENUE TO FRONTIER PARK

FIGURE C-28 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, FRONTIER PARK TO PERSHING BOULEVARD

FIGURE C-29 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, PERSHING BOULEVARD TO MISSILE DRIVE

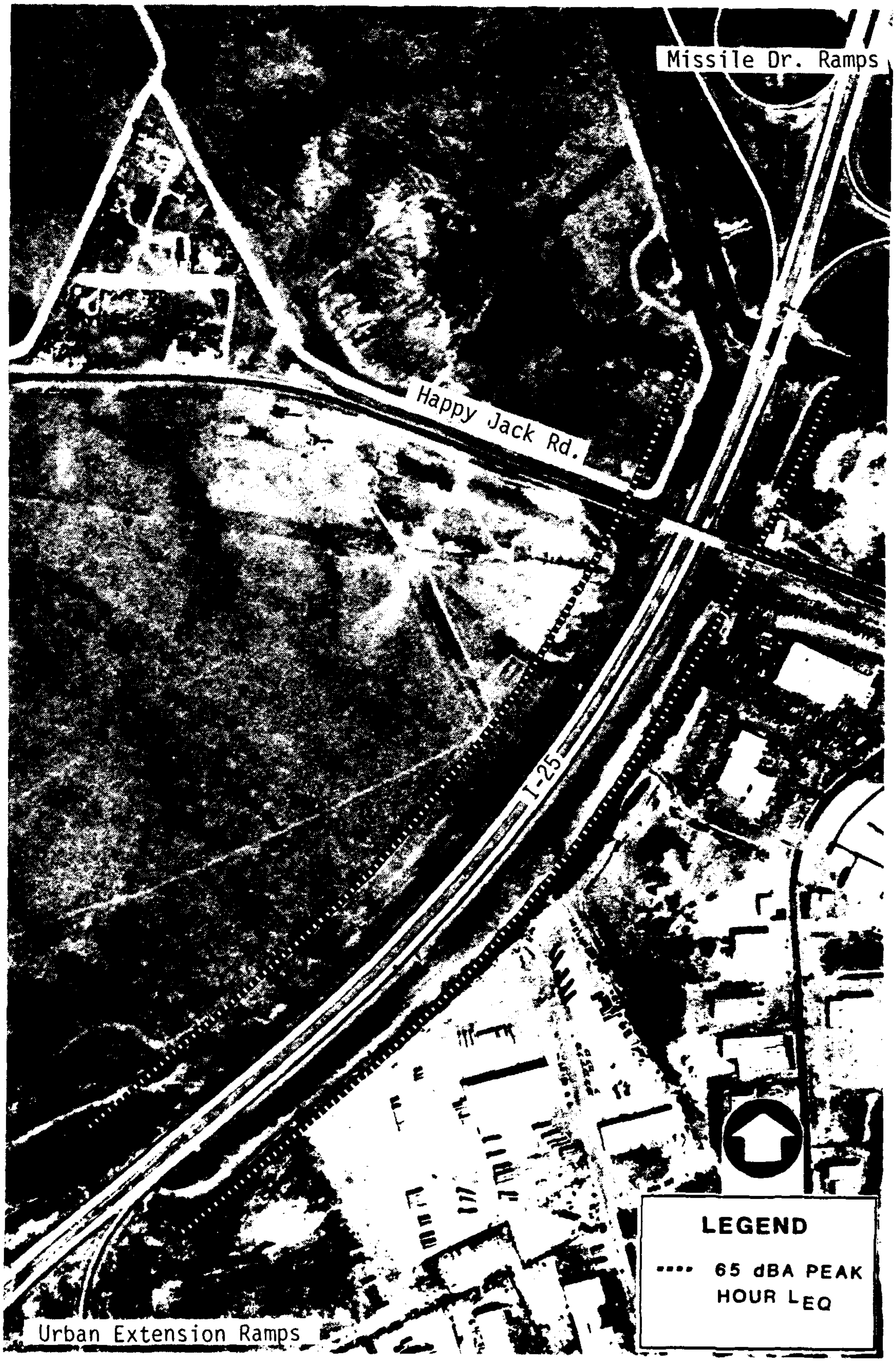


FIGURE C-30 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, MISSILE DRIVE TO U.S.30 RAMPS

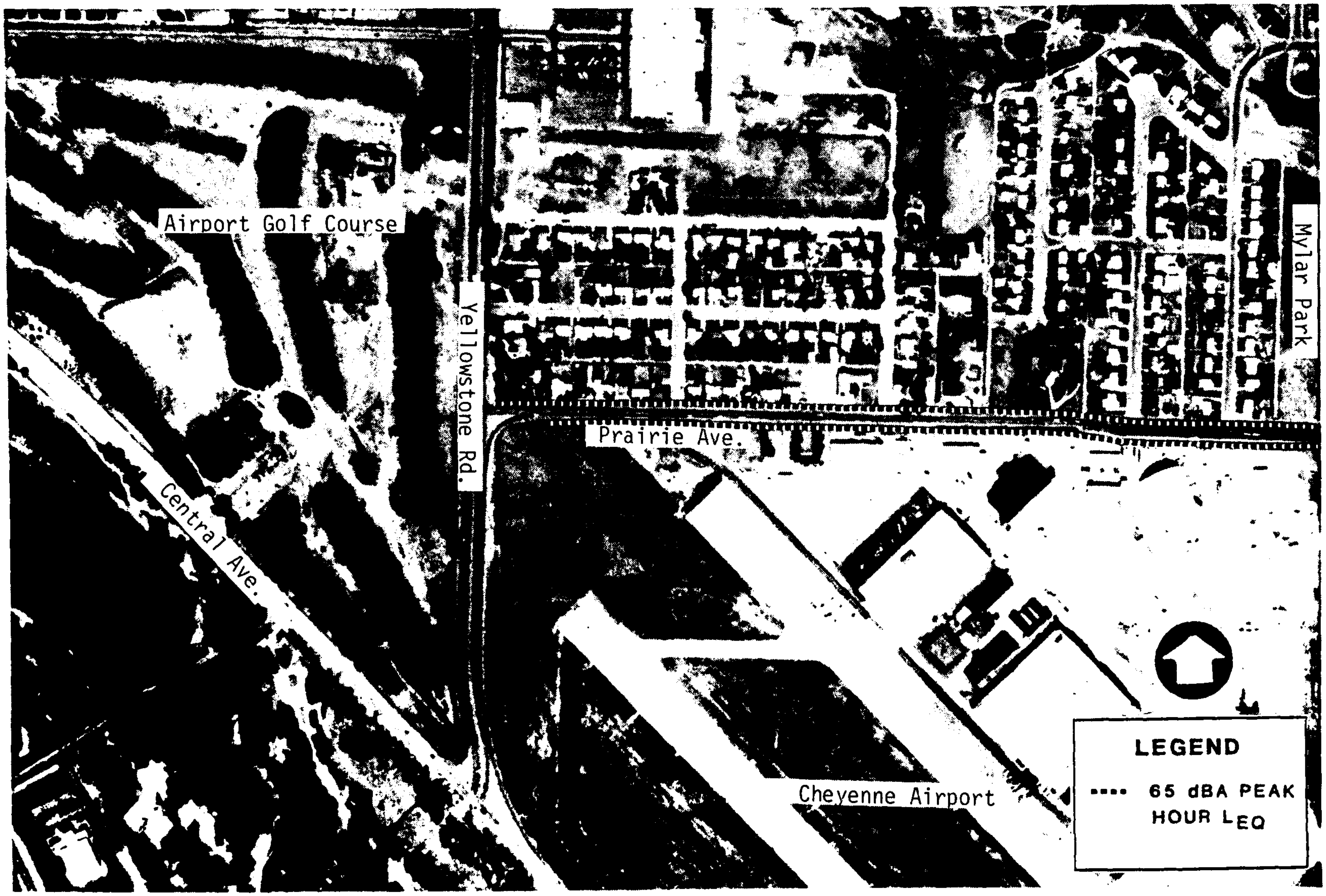


FIGURE C-31 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PRAIRIE AVENUE, YELLOWSTONE ROAD TO MYLAR PARK

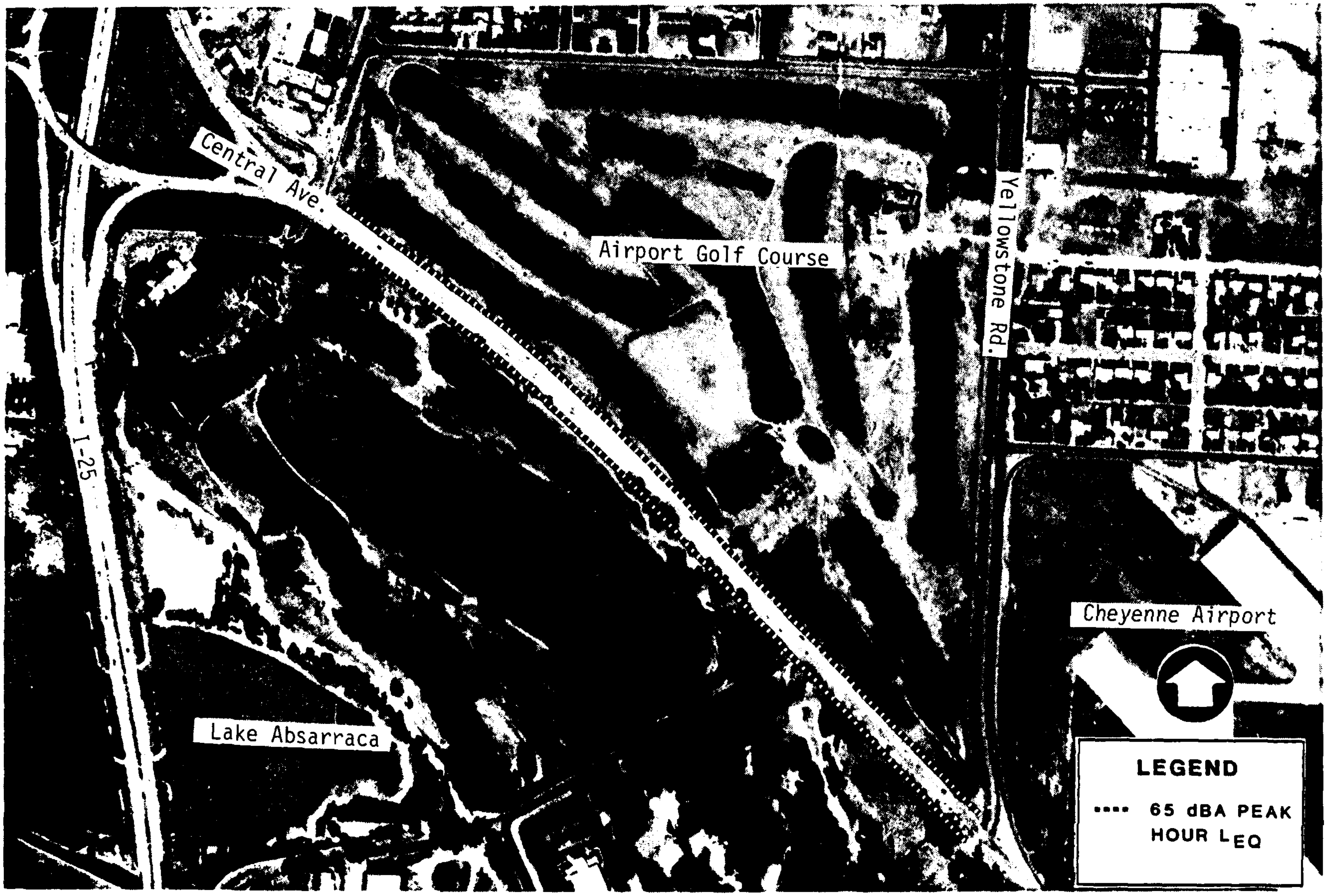


FIGURE C-32 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, I-25 TO YELLOWSTONE ROAD

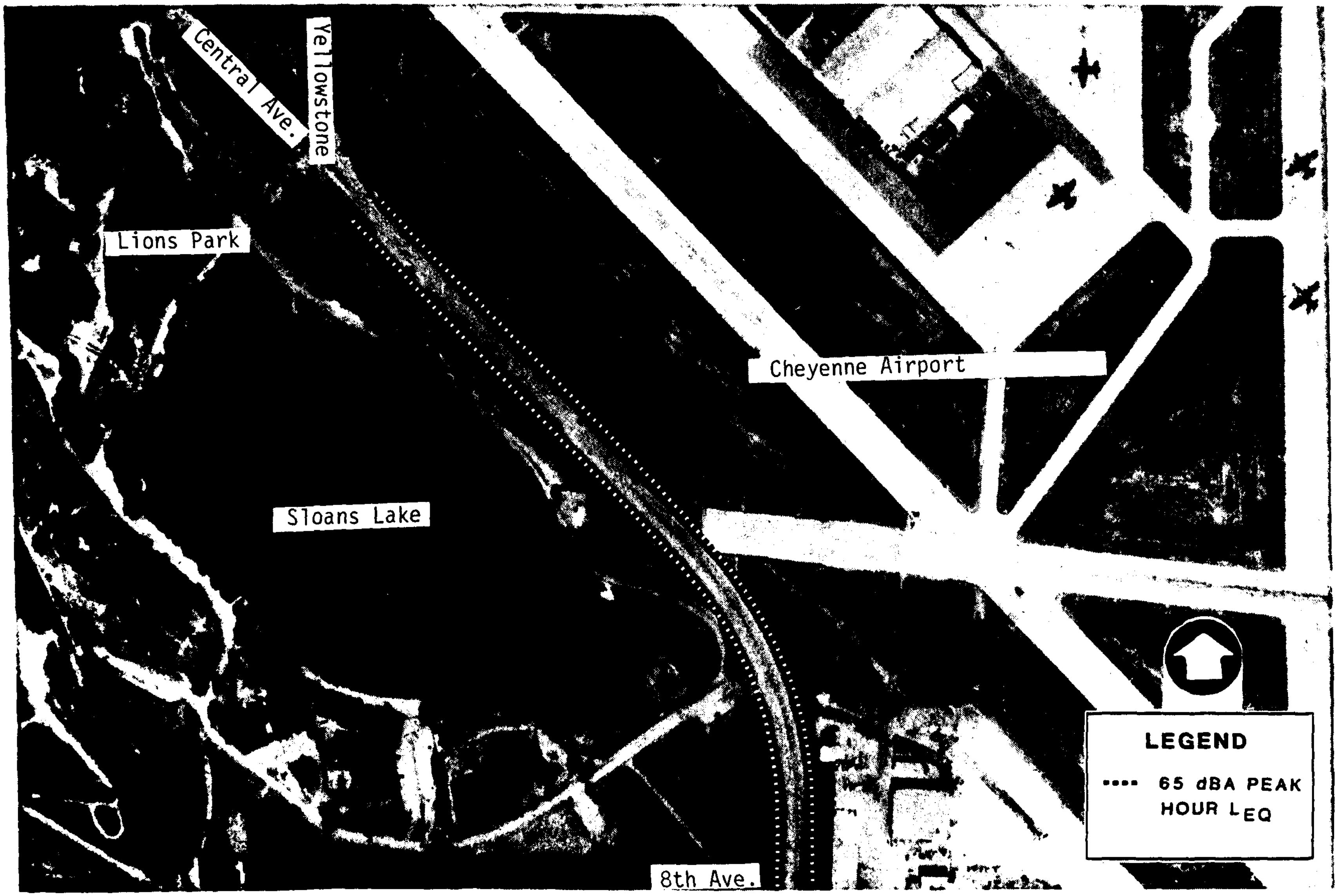


FIGURE C-33 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, YELLOWSTONE ROAD TO EIGHTH AVENUE

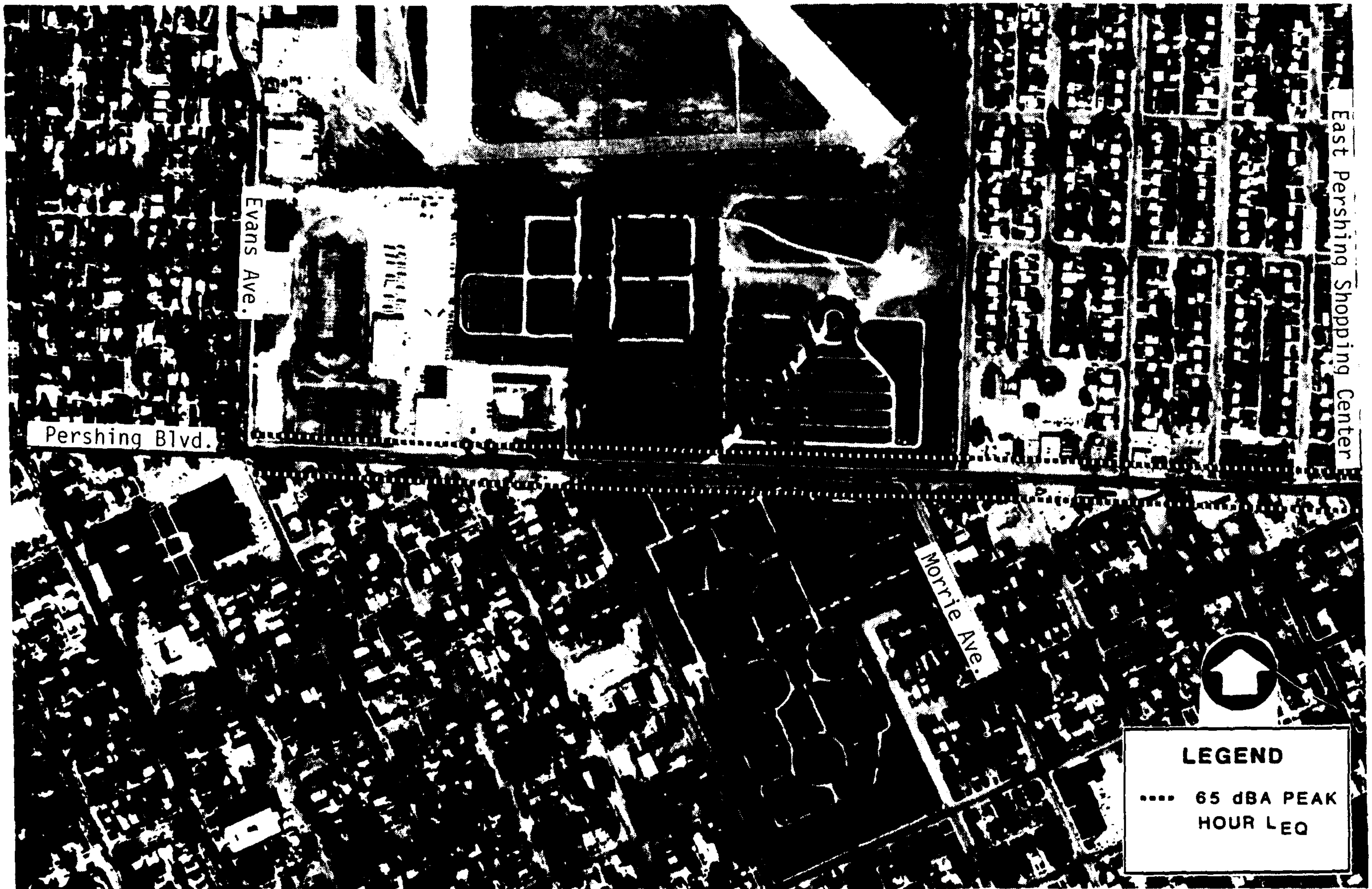


FIGURE C-34 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EVANS AVENUE TO EAST PERSHING SHOPPING CENTER

FIGURE C-35 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST PERSHING SHOPPING CENTER TO CONVERSE AVENUE

FIGURE C-36 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD EAST OF CONVERSE AVENUE

FIGURE C-37 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, VICINITY OF WINDMILL ROAD

FIGURE C-33 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, COLLEGE DRIVE, BETWEEN PARSLEY BOULEVARD AND WALTERSCHEID BOULEVARD

FIGURE C-39 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR DELL RANGE BOULEVARD

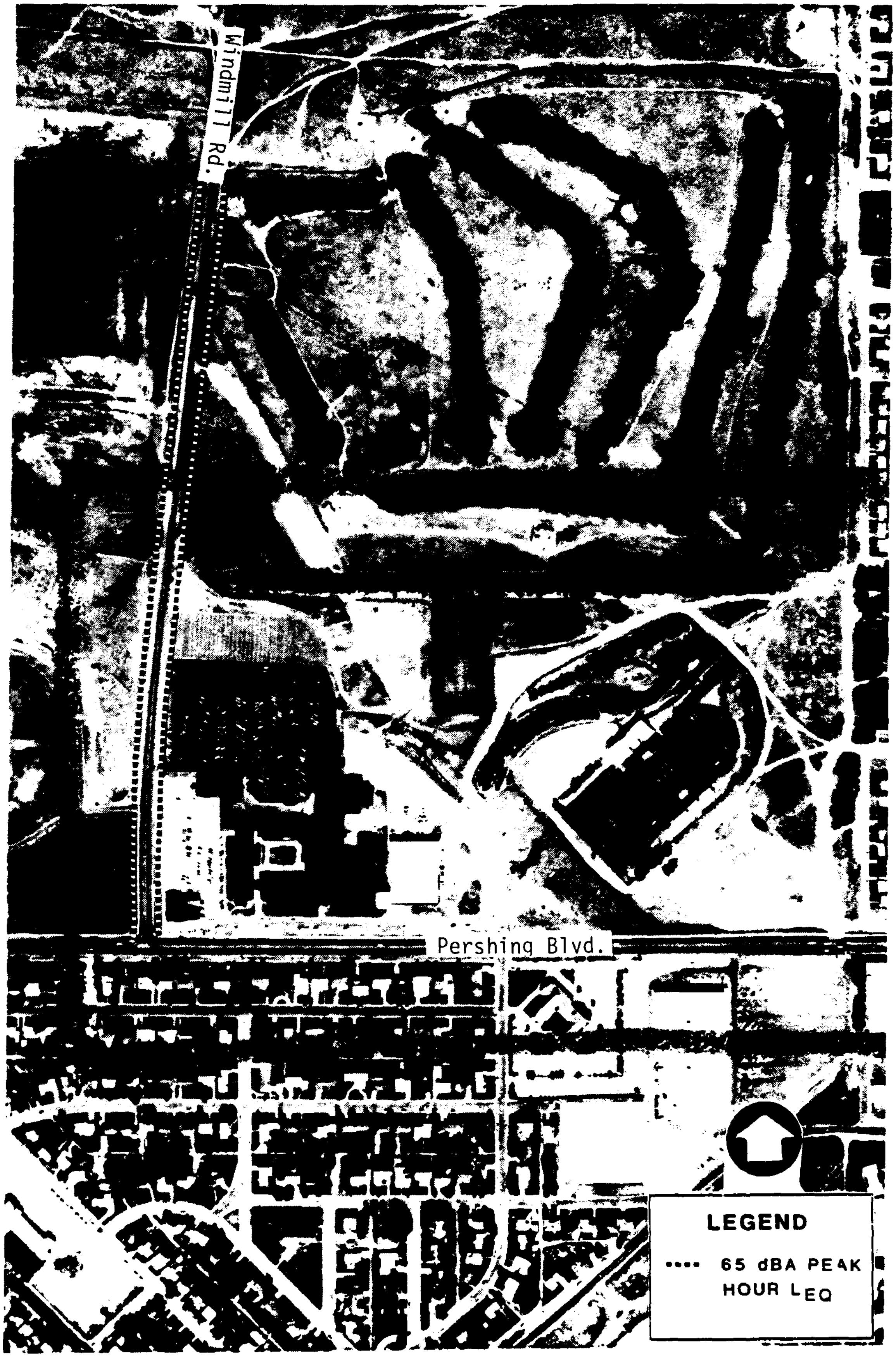


FIGURE C-40 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR PERSHING BOULEVARD

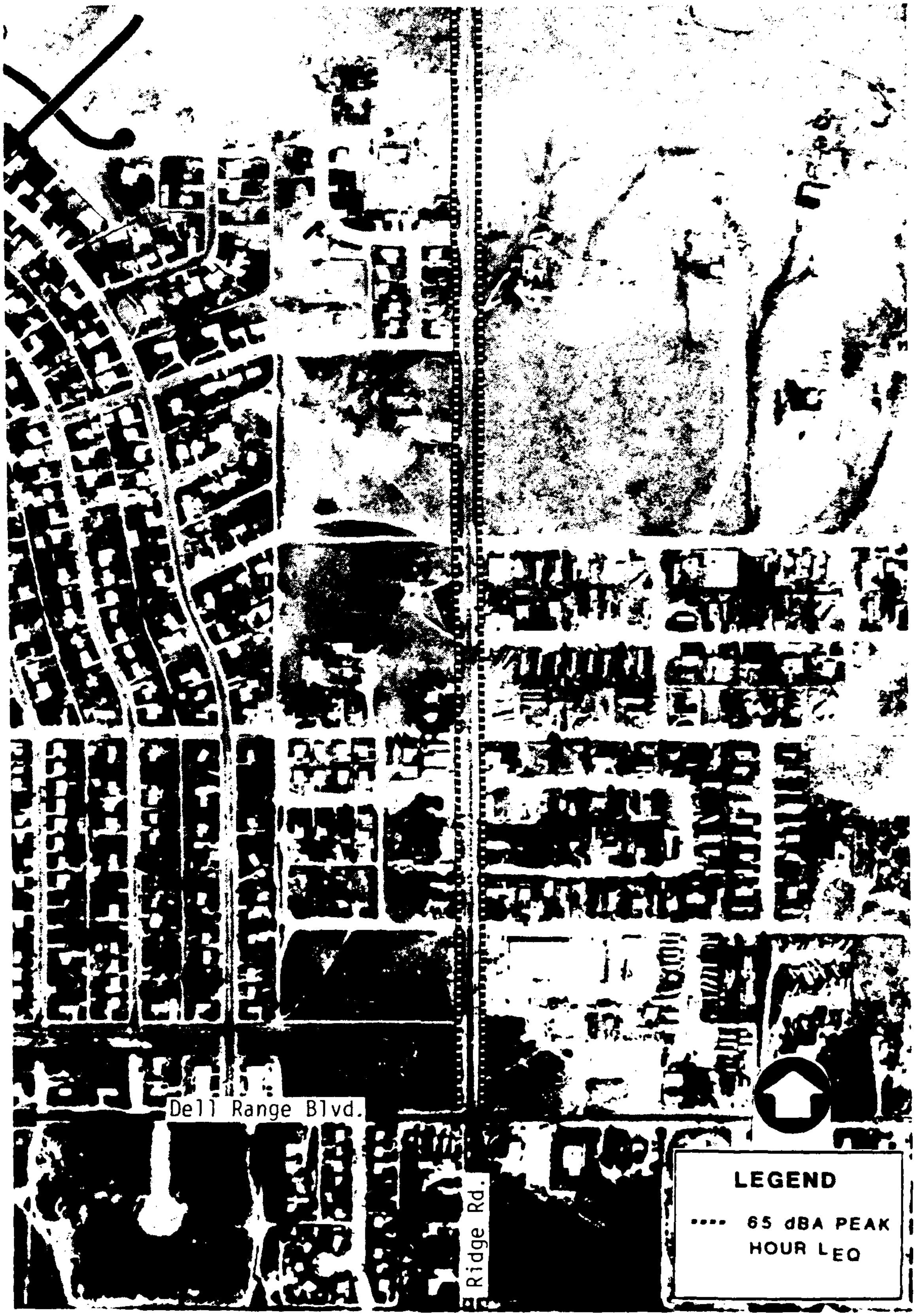


FIGURE C-41 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, NORTH OF DELL RANGE BOULEVARD

FIGURE C-42 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, THOMAS ROAD TO GLENCOE DRIVE

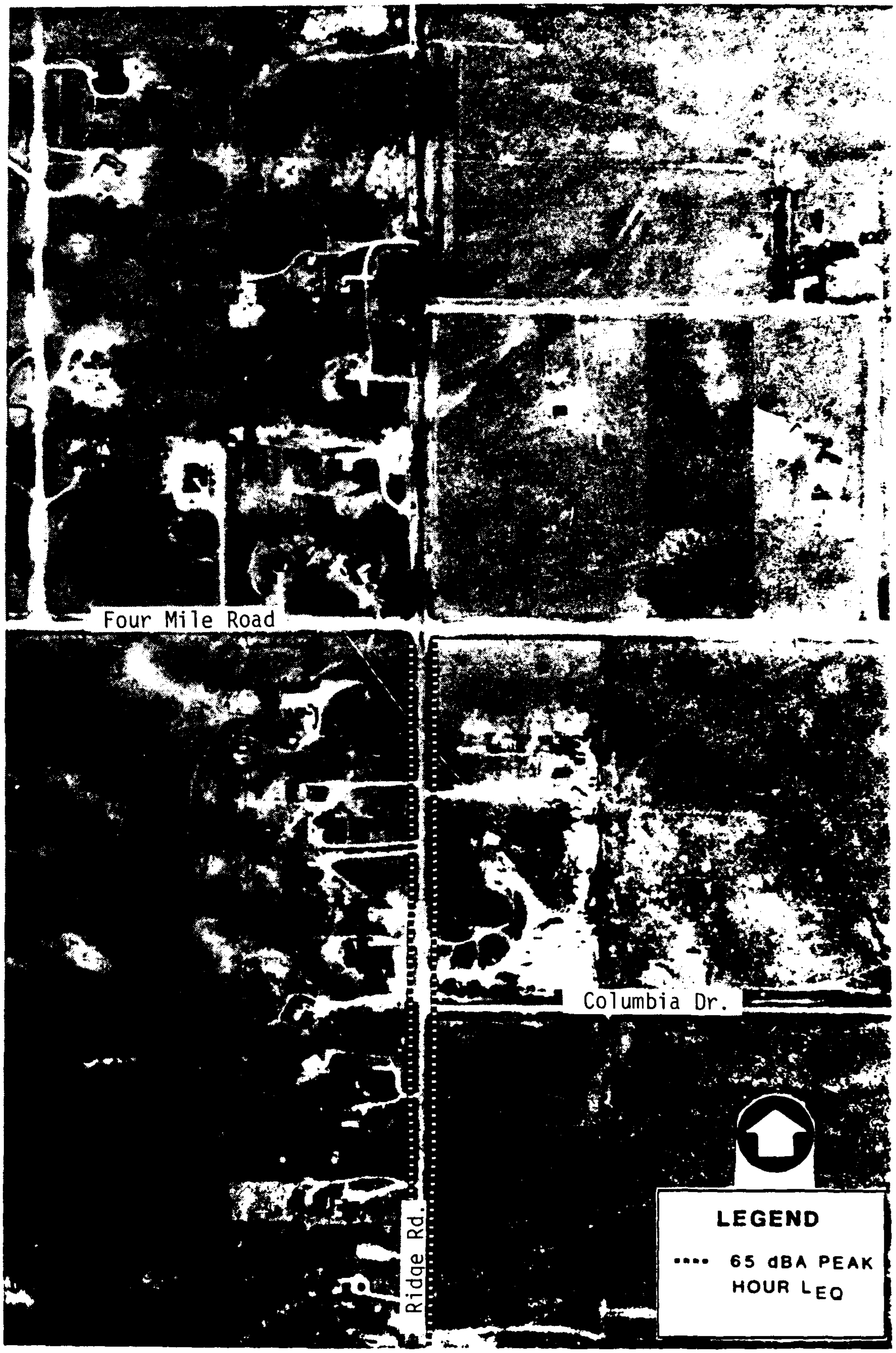


FIGURE C-43 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD SOUTH OF FOUR MILE ROAD

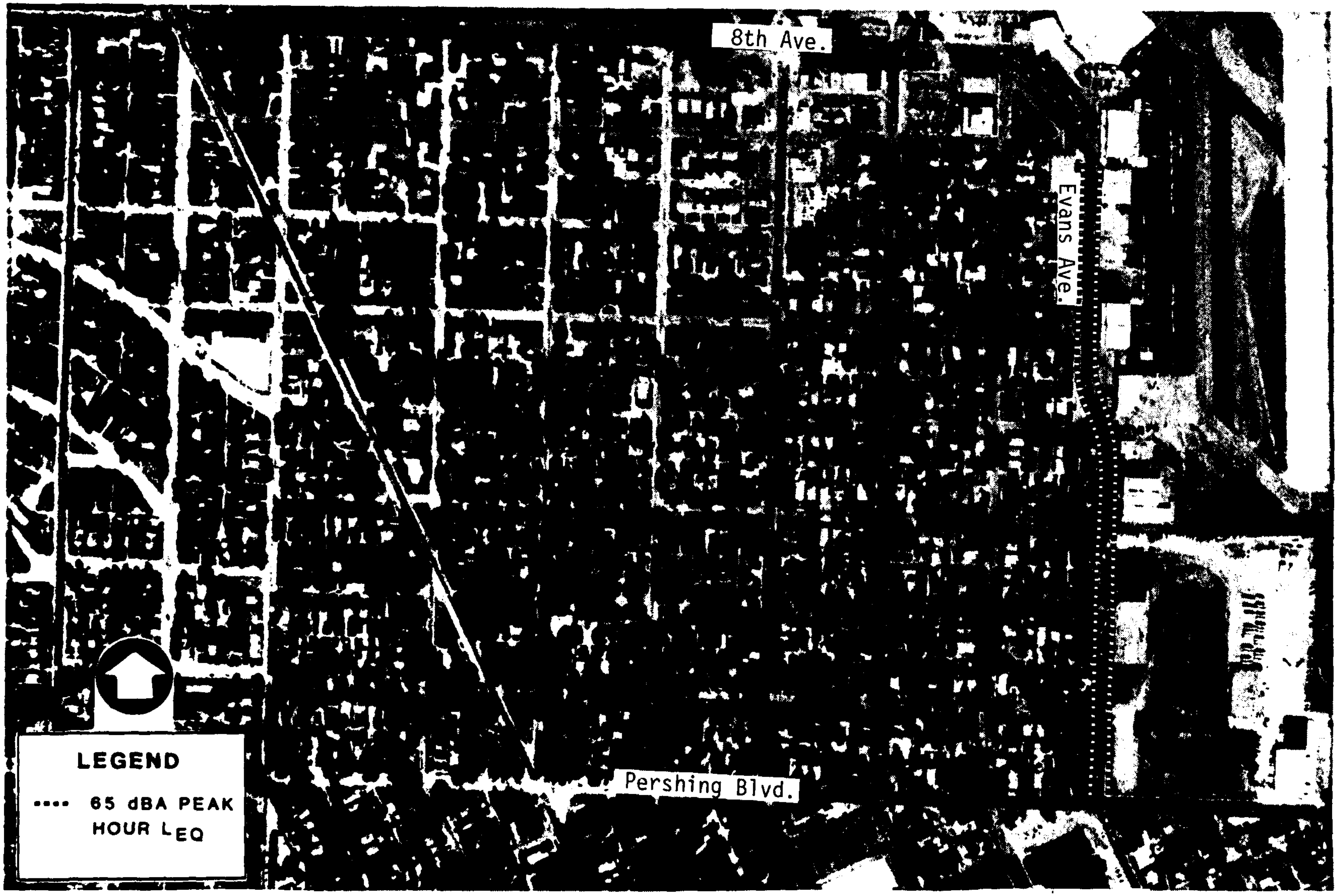


FIGURE C-44 NO ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, EVANS AVENUE, EIGHTH AVENUE TO PERSHING BOULEVARD

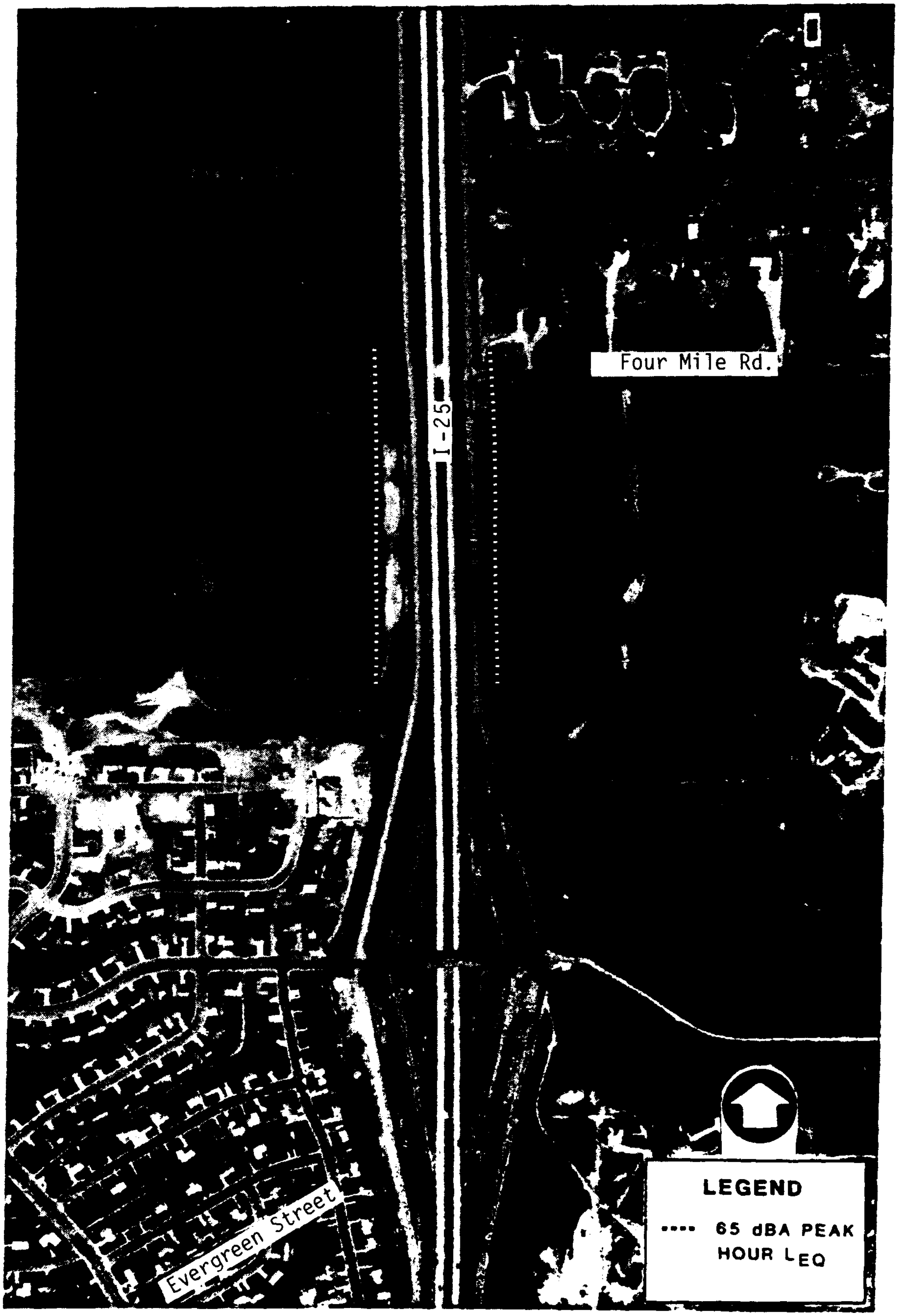


FIGURE C-45 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS,
I-25, FOUR MILE ROAD TO EVERGREEN STREET

FIGURE C-46 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, EVERGREEN STREET TO CENTRAL AVENUE RAMPS

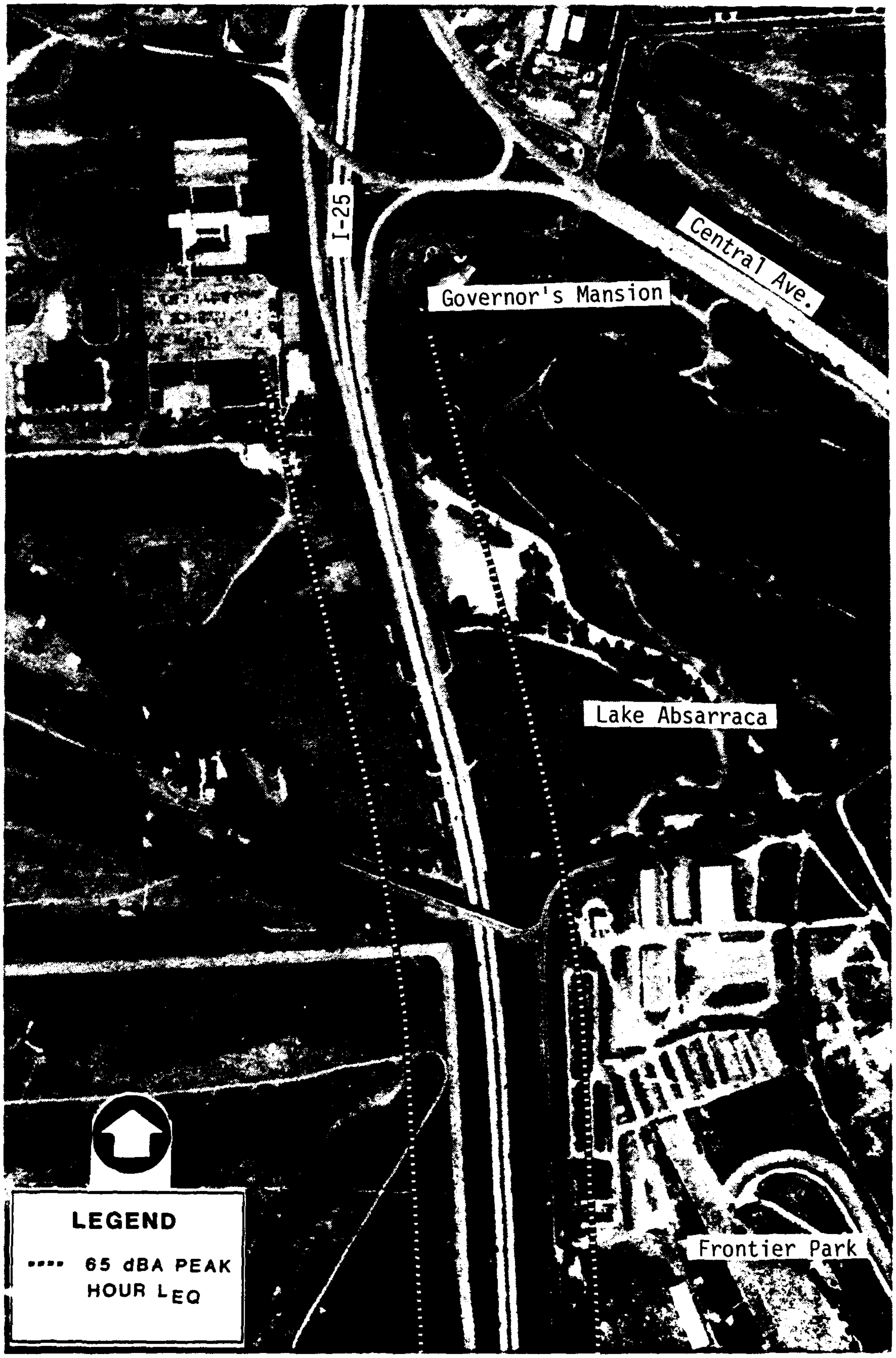


FIGURE C-47 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, CENTRAL AVENUE TO FRONTIER PARK

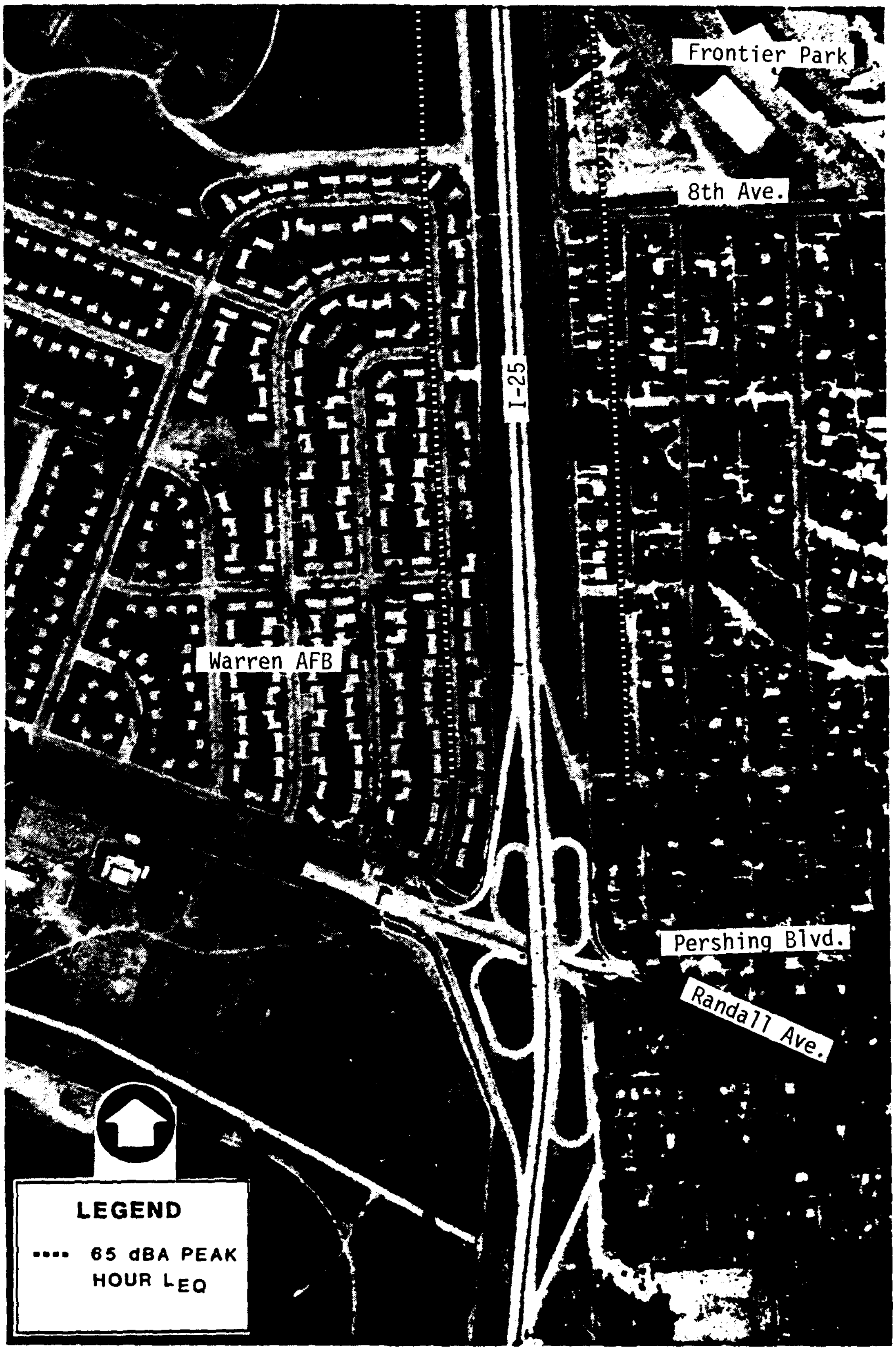


FIGURE C-48 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, FRONTIER PARK TO PERSHING BOULEVARD

FIGURE C-49 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS,
I-25, PERSHING BOULEVARD TO MISSILE DRIVE

FIGURE C-50 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, I-25, MISSILE DRIVE TO U.S. 30 RAMPS

FIGURE C-51 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PRAIRIE AVENUE, YELLOWSTONE ROAD TO MYLAR PARK

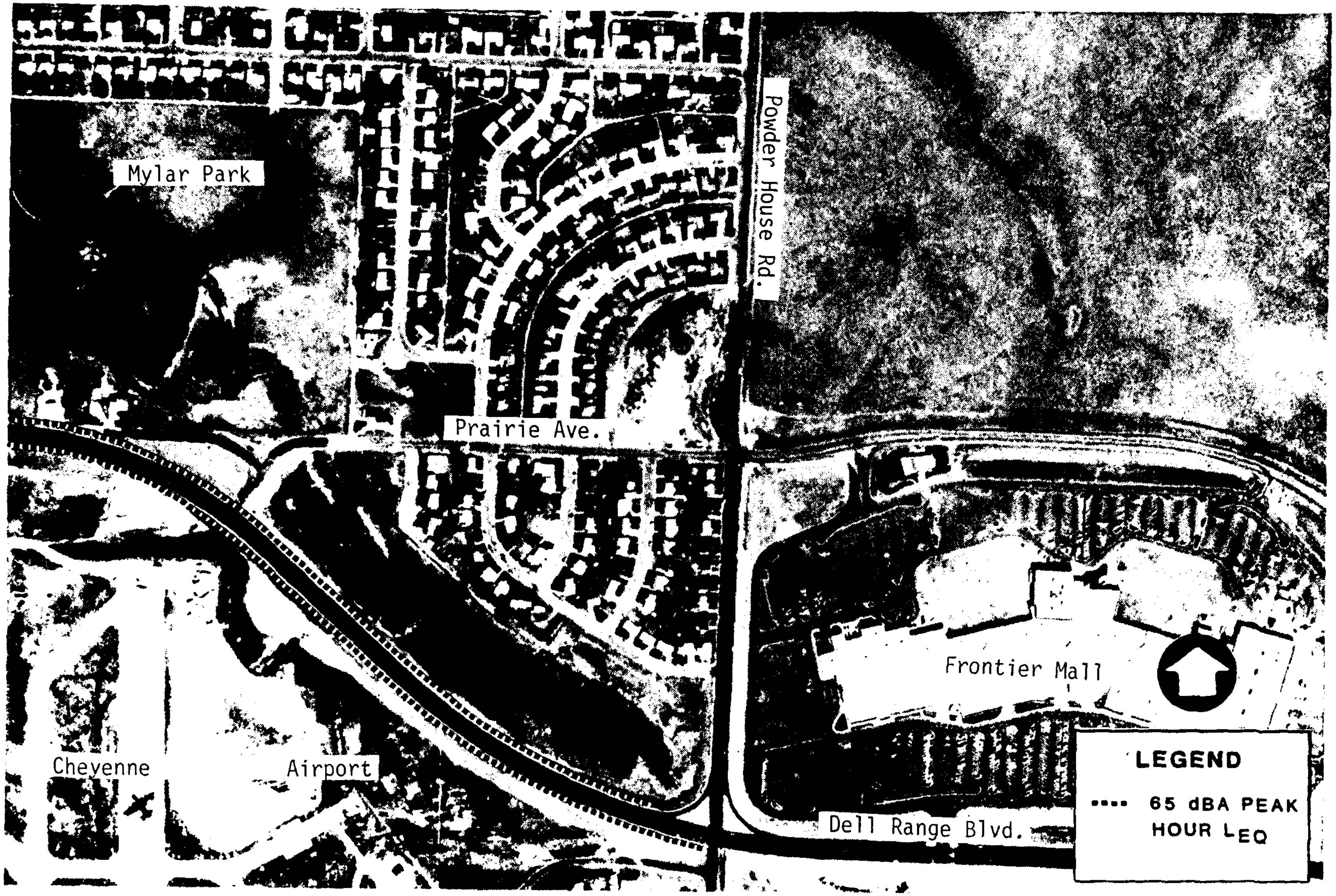


FIGURE C-52 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, DELL RANGE BOULEVARD, MYLAR PARK TO POWDER HOUSE ROAD

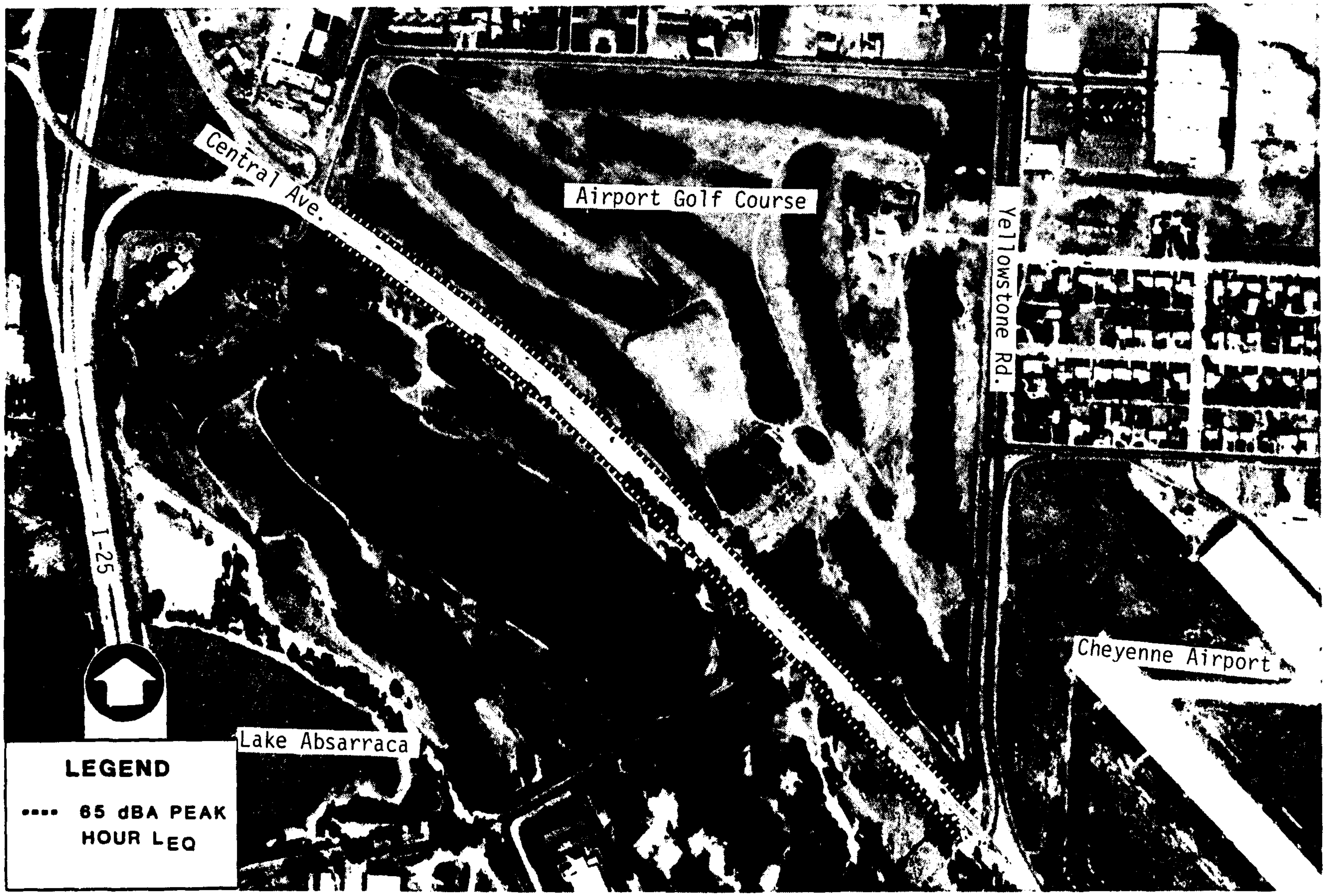


FIGURE C-53 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, I-25 TO YELLOWSTONE ROAD

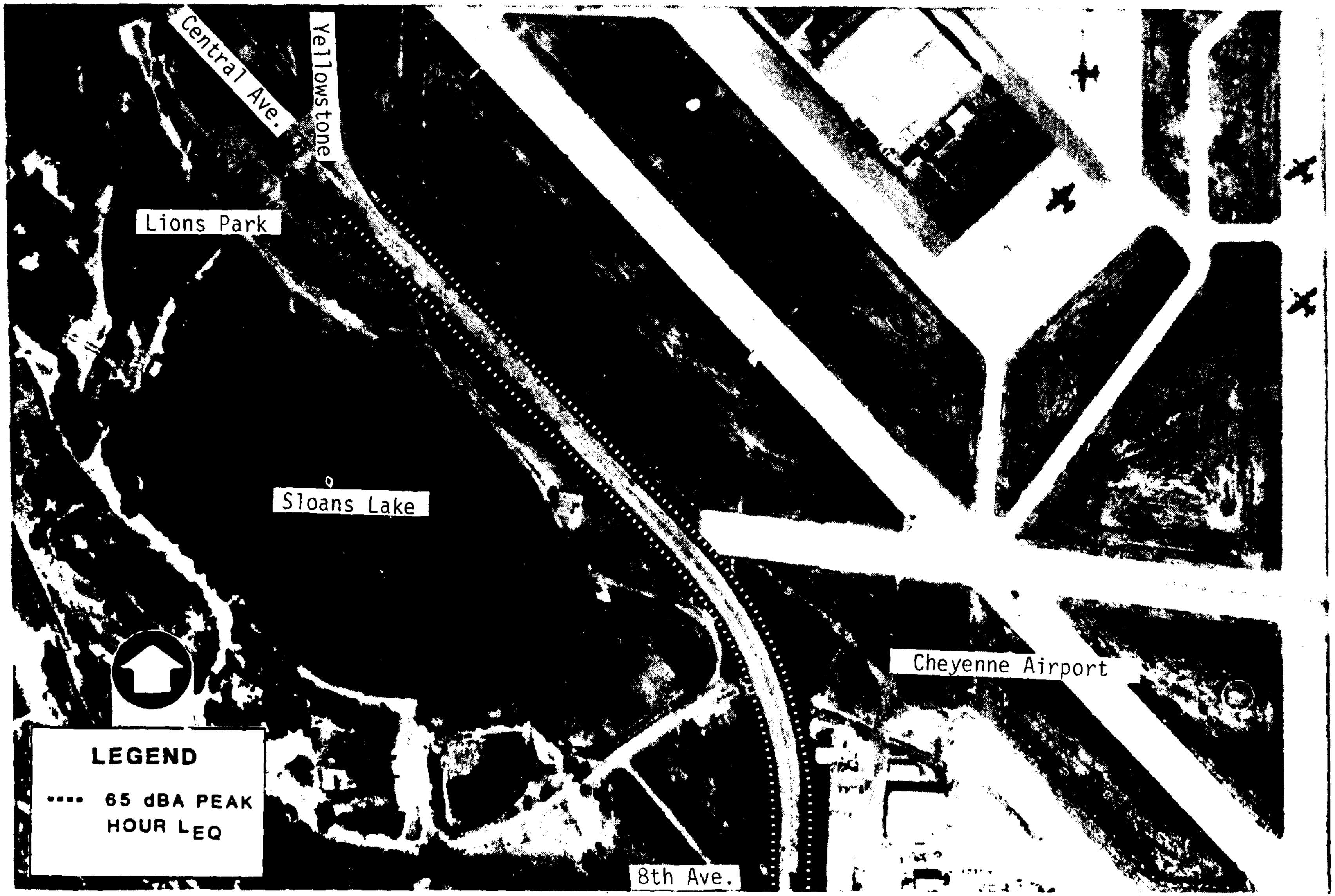


FIGURE C-54 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, YELLOWSTONE ROAD TO EIGHTH AVENUE

FIGURE C-55 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, BENT AVENUE TO EVANS AVENUE

FIGURE C-56 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EVANS AVENUE TO EAST PERSHING SHOPPING CENTER

FIGURE C-57 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST PERSHING SHOPPING CENTER TO CONVERSE AVENUE

FIGURE C-58 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD EAST OF CONVERSE AVENUE

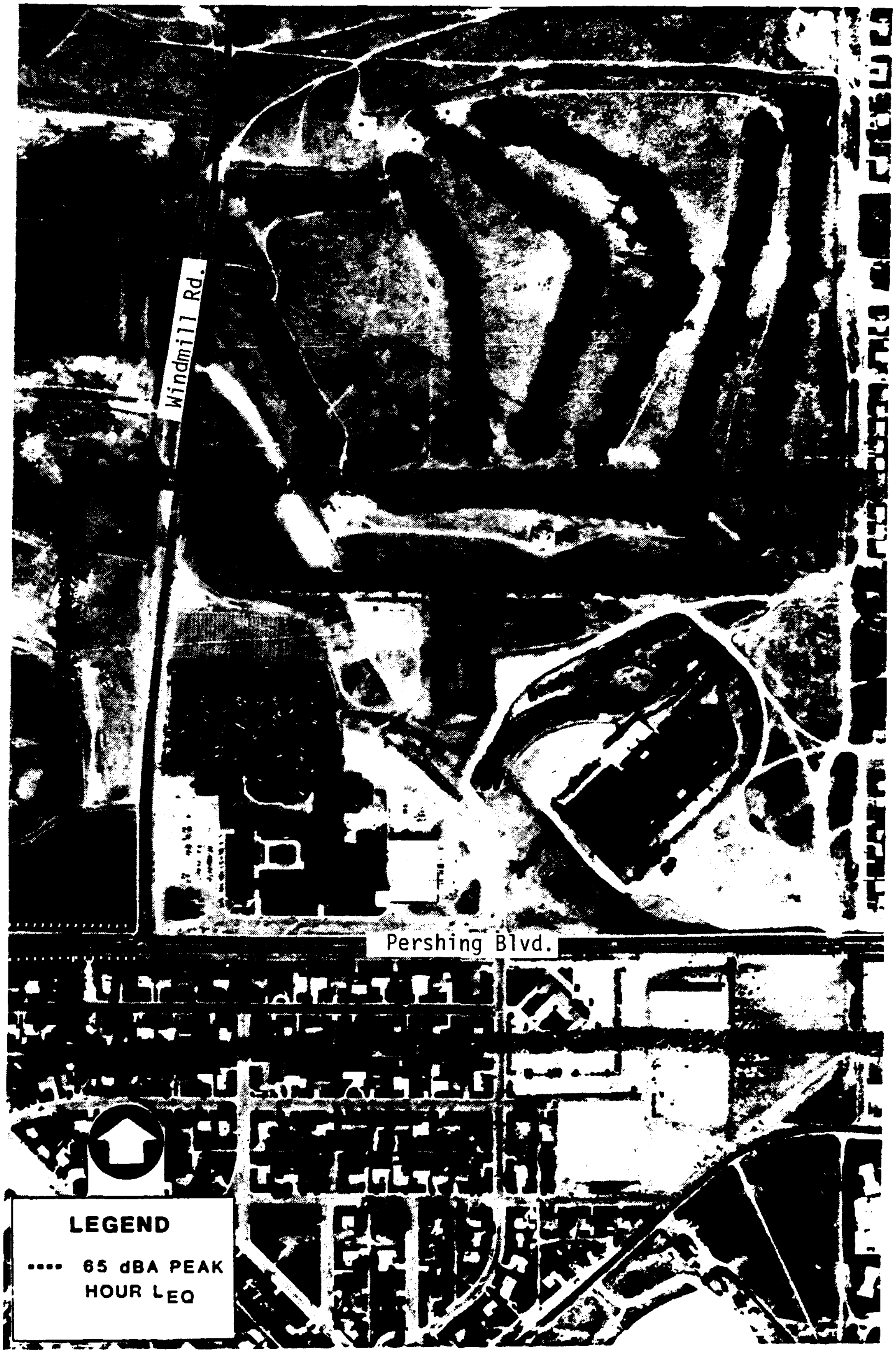


FIGURE C-59 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, VICINITY OF WINDMILL ROAD

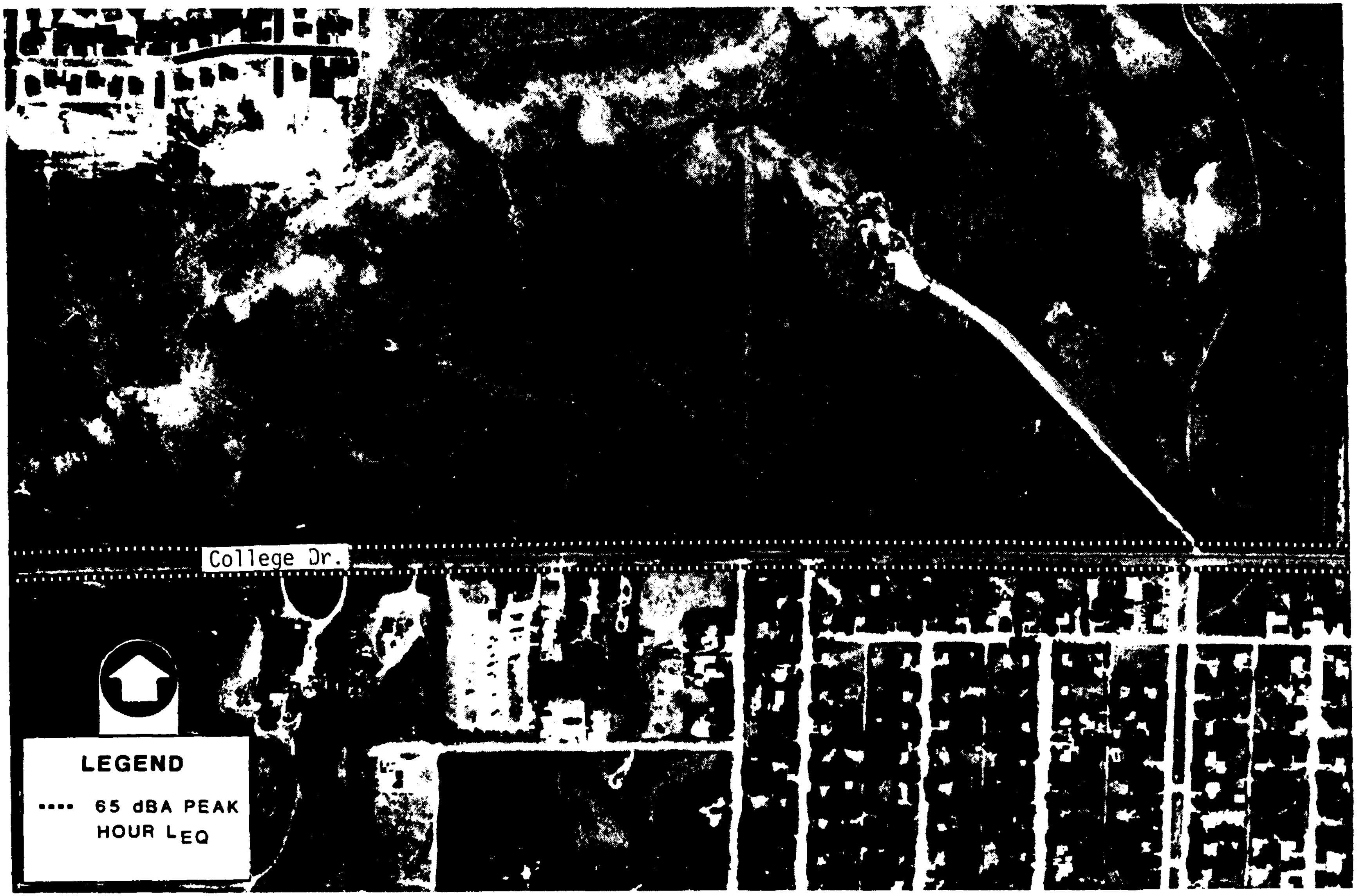


FIGURE C-60 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, COLLEGE DRIVE, BETWEEN PARSLEY BOULEVARD AND WALTERSCHEID BOULEVARD

FIGURE C-61 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR DELL RANGE BOULEVARD

FIGURE C-62 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR PERSHING BOULEVARD

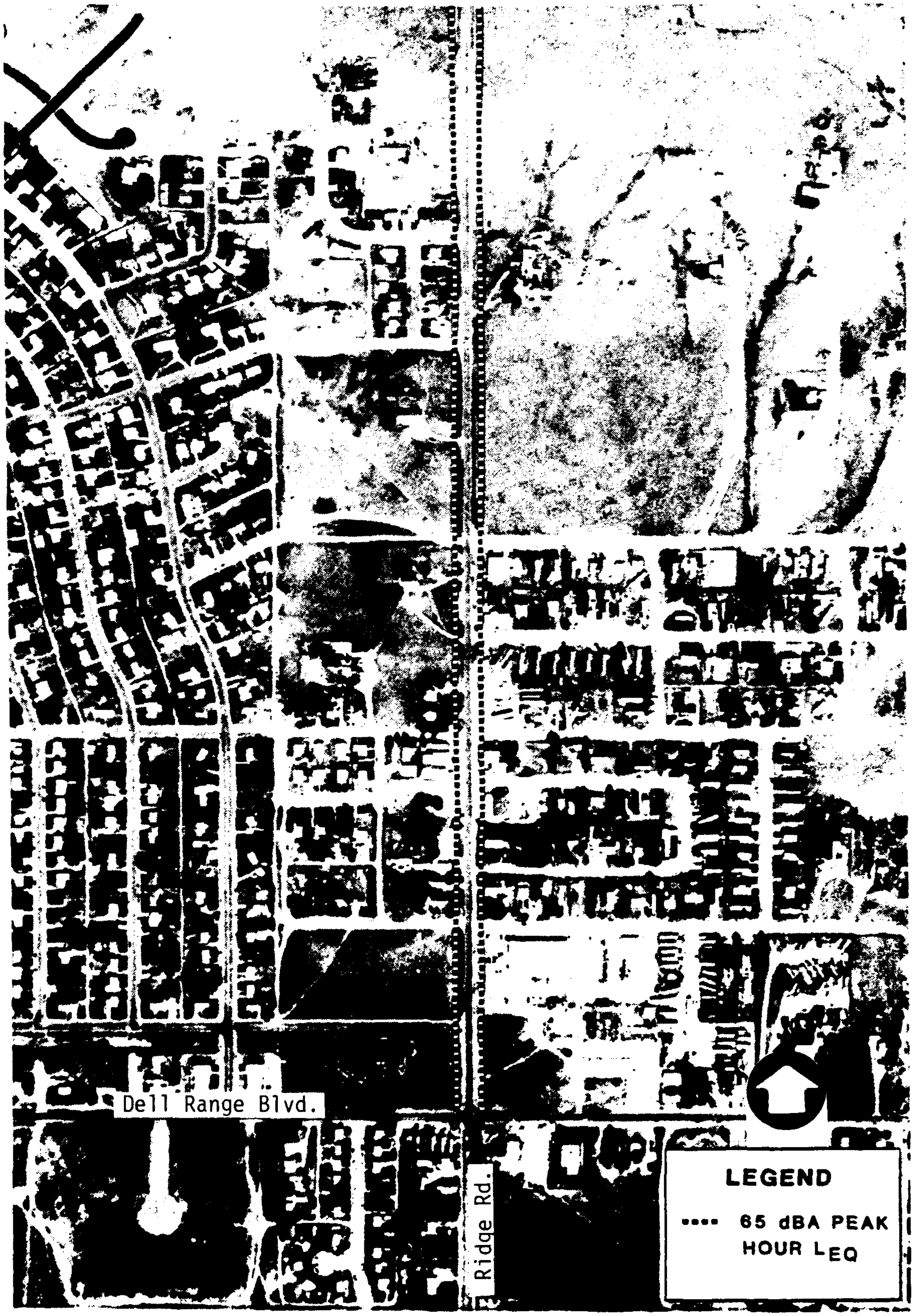


FIGURE C-63 PROPOSED ACTION 1985 NOISE LEVEL CONTOURS, RIDGE ROAD, NORTH OF DELL RANGE BOULEVARD

FIGURE C-64 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, THOMAS ROAD TO GLENCOE DRIVE

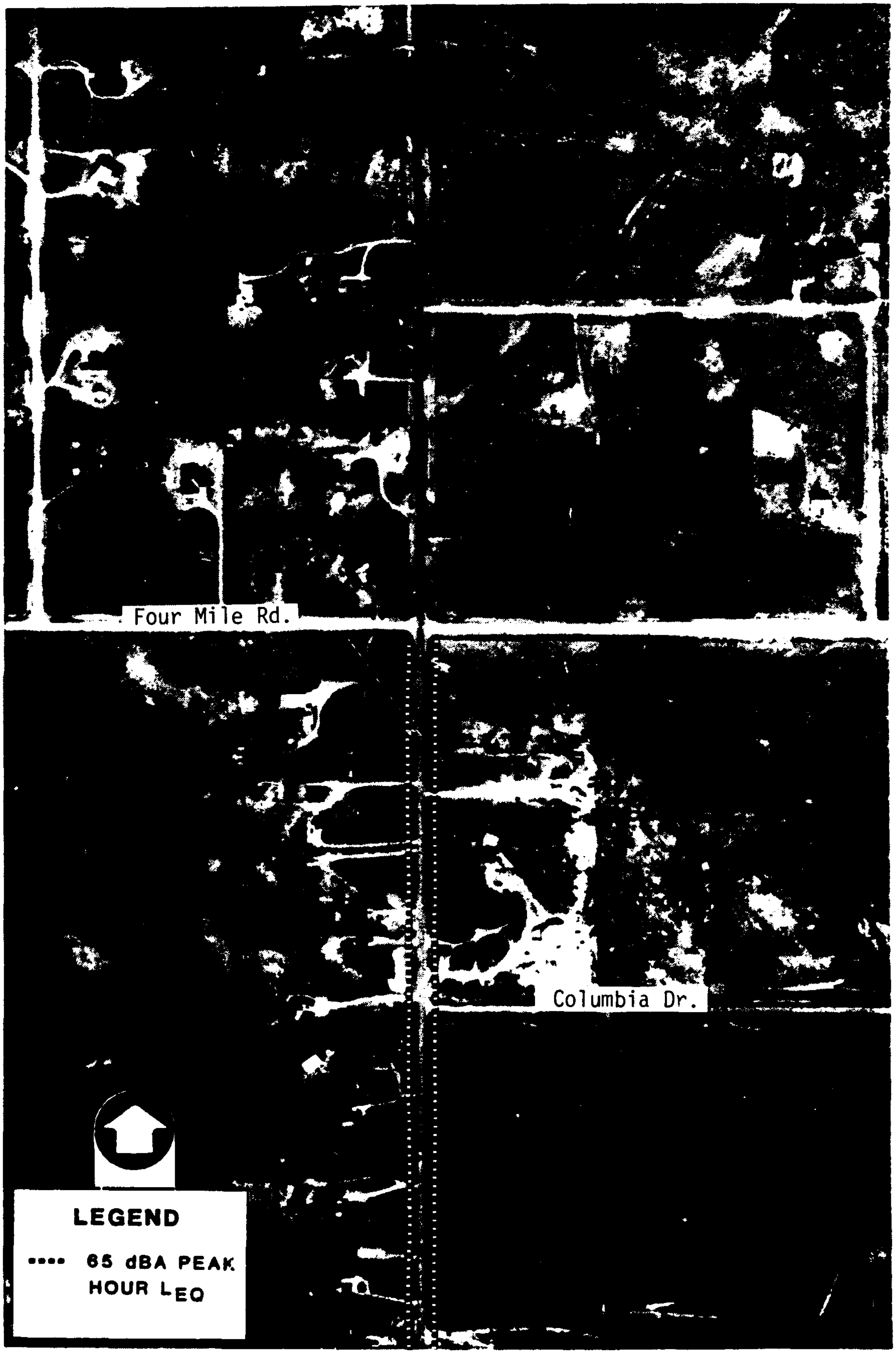


FIGURE C-65 PROPOSED 1985 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, SOUTH OF FOUR MILE ROAD

FIGURE C-66 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, EVANS AVENUE, EIGHTH AVENUE TO PERSHING BOULEVARD

FIGURE C-67 PROPOSED ACTION 1985 L_{EQ} NOISE LEVEL CONTOURS, AMES AVENUE, DEMING DRIVE TO 20th STREET

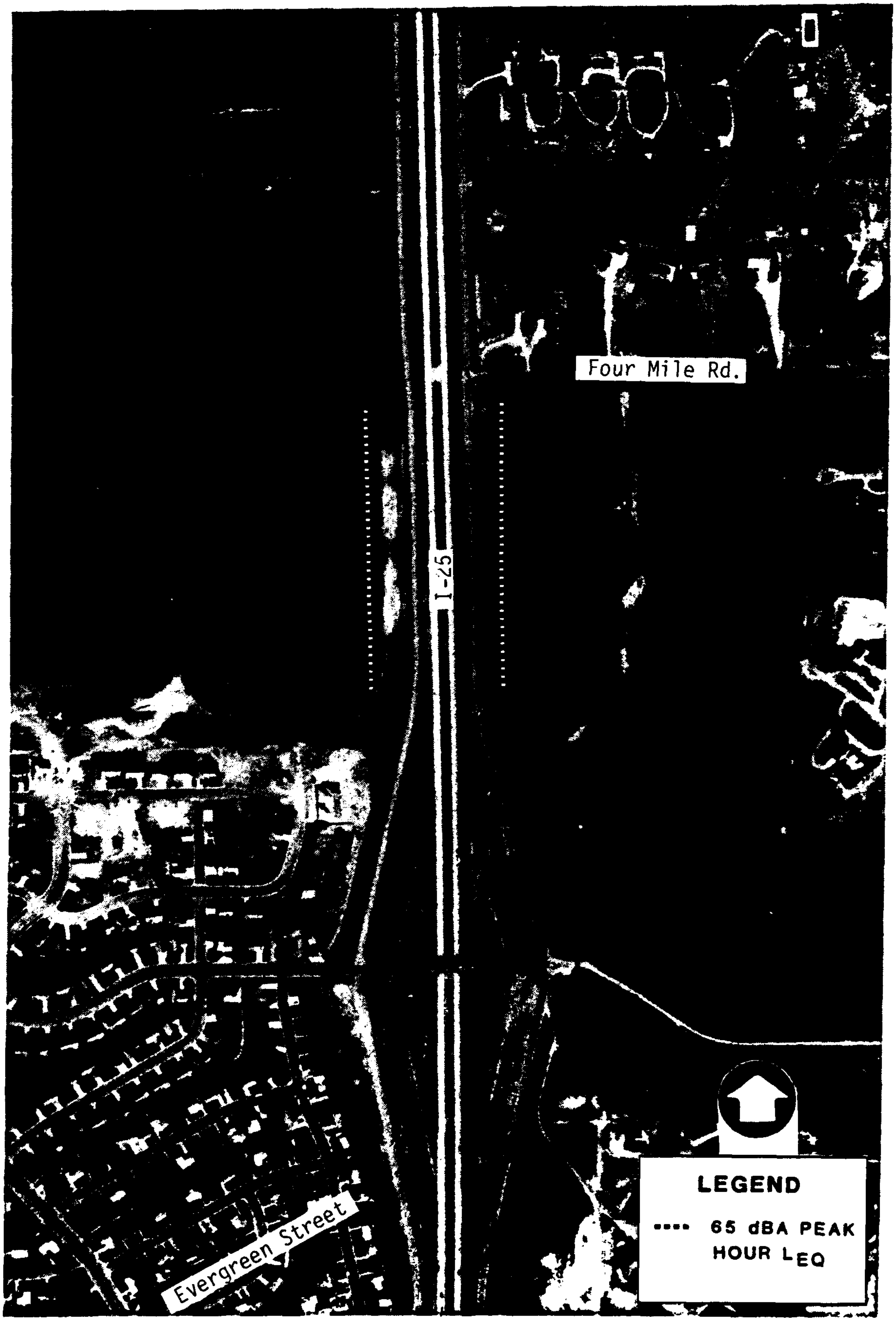


FIGURE C-68 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, FOUR MILE ROAD TO EVERGREEN STREET

FIGURE C-69 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, EVERGREEN STREET TO CENTRAL AVENUE RAMPS

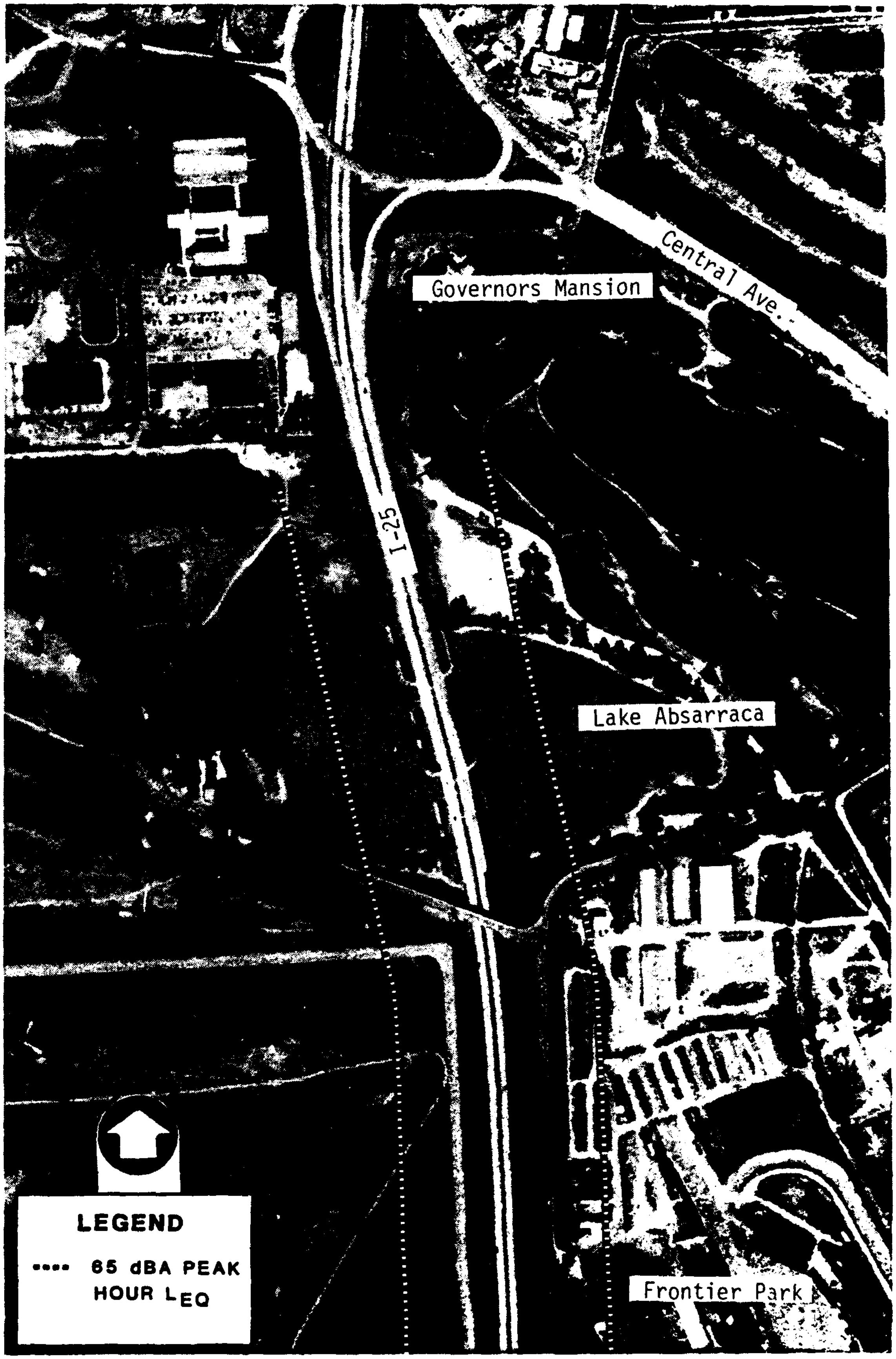


FIGURE C-70 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, CENTRAL AVENUE TO FRONTIER PARK

FIGURE C-71 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, FRONTIER PARK TO PERSHING BOULEVARD

FIGURE C-72 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, PERSHING BOULEVARD TO MISSILE DRIVE

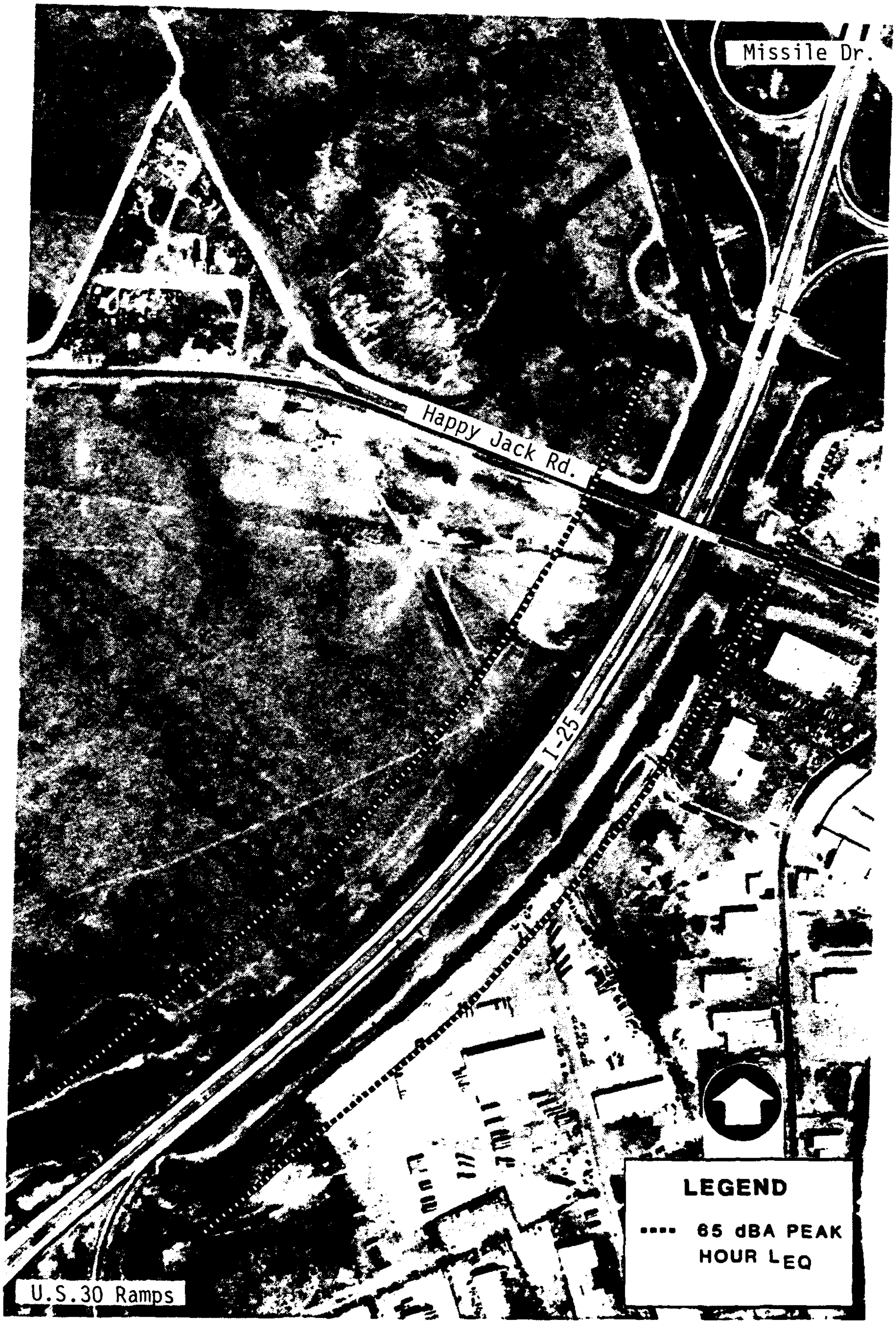


FIGURE C-73 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, I-25, MISSILE DRIVE TO U.S. 30 RAMPS

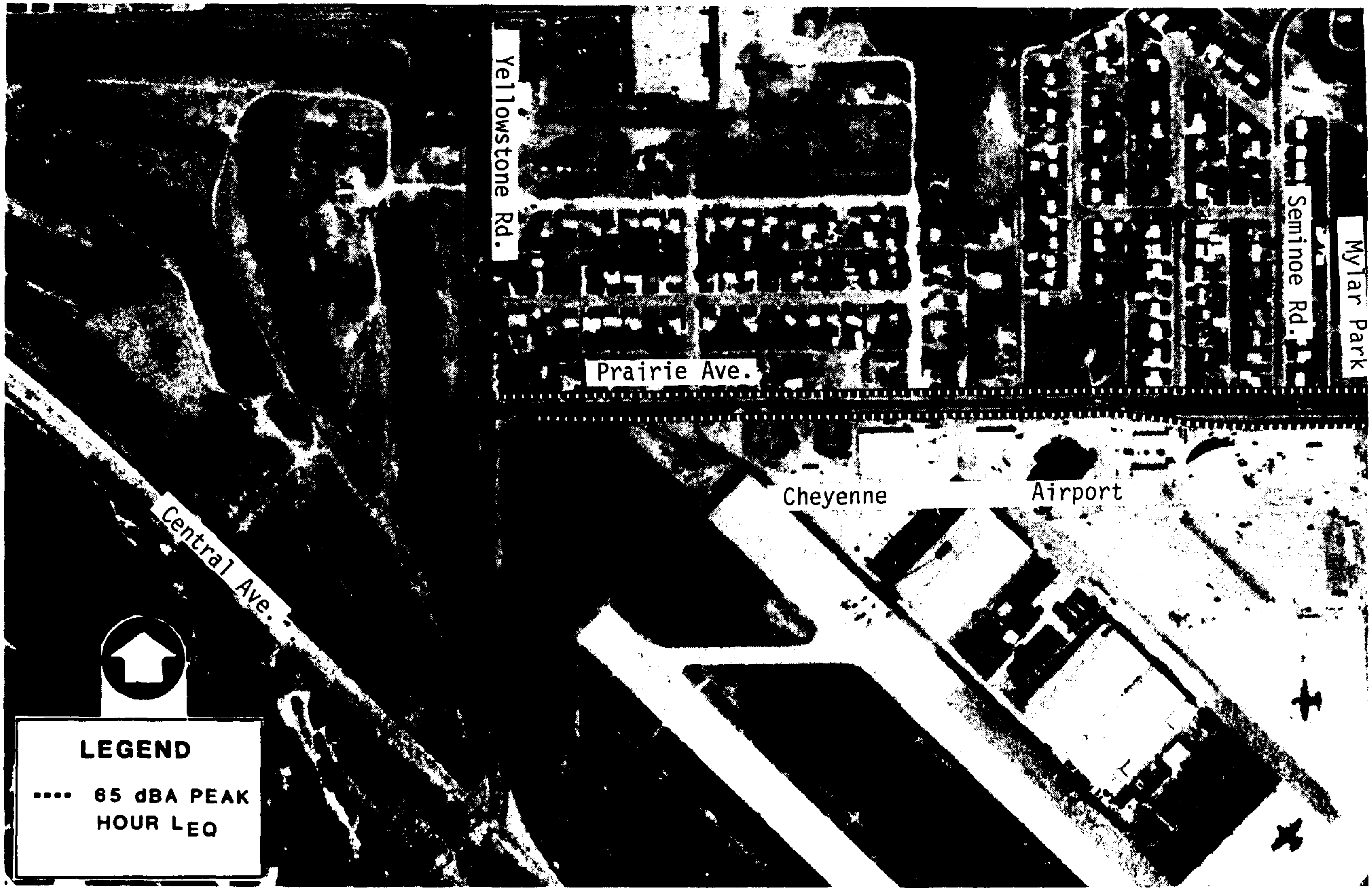


FIGURE C-74 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PRAIRIE AVENUE, YELLOWSTONE ROAD TO MYLAR PARK

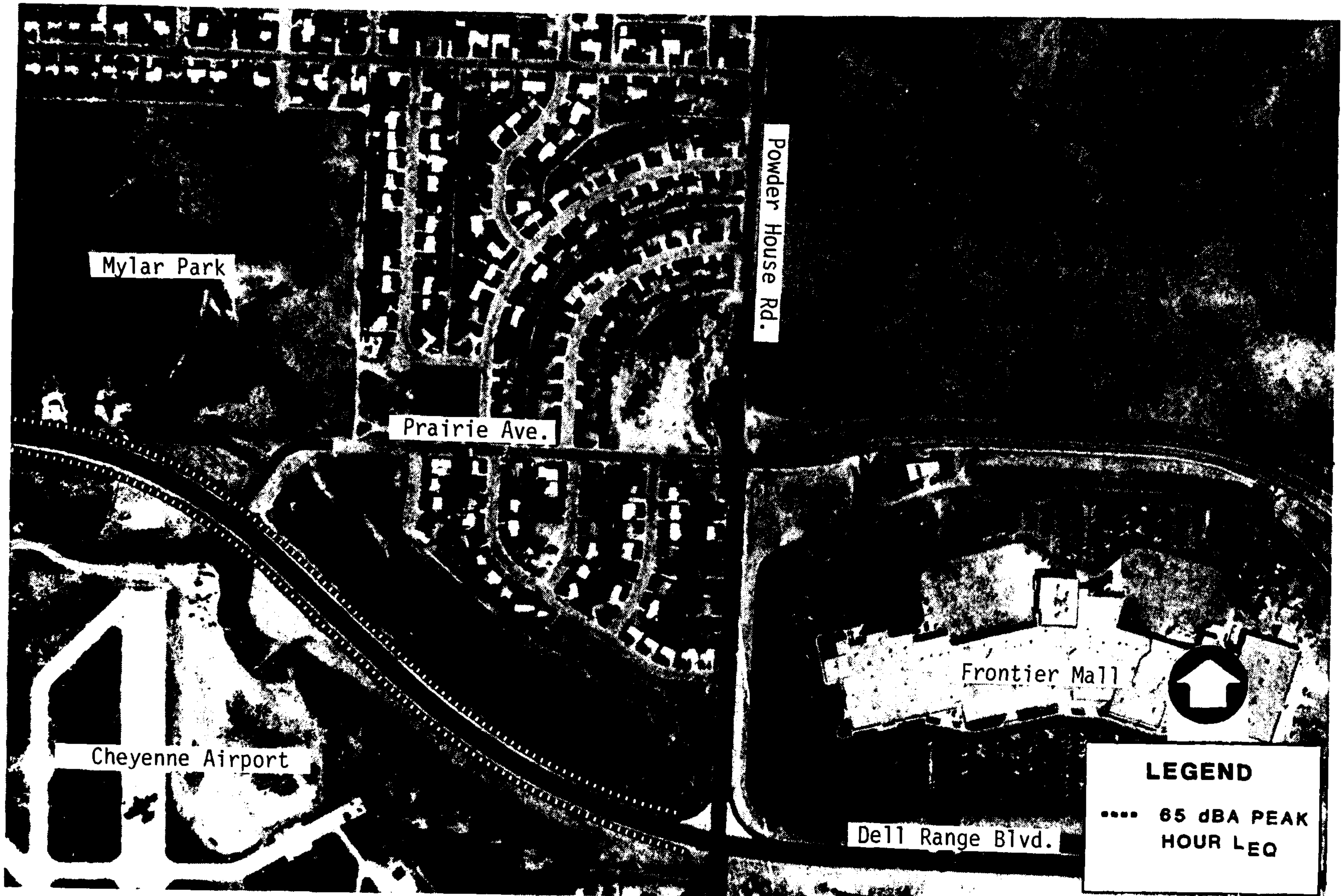


FIGURE C-75 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, DELL RANGE BOULEVARD, MYLAR PARK TO POWDER HOUSE ROAD

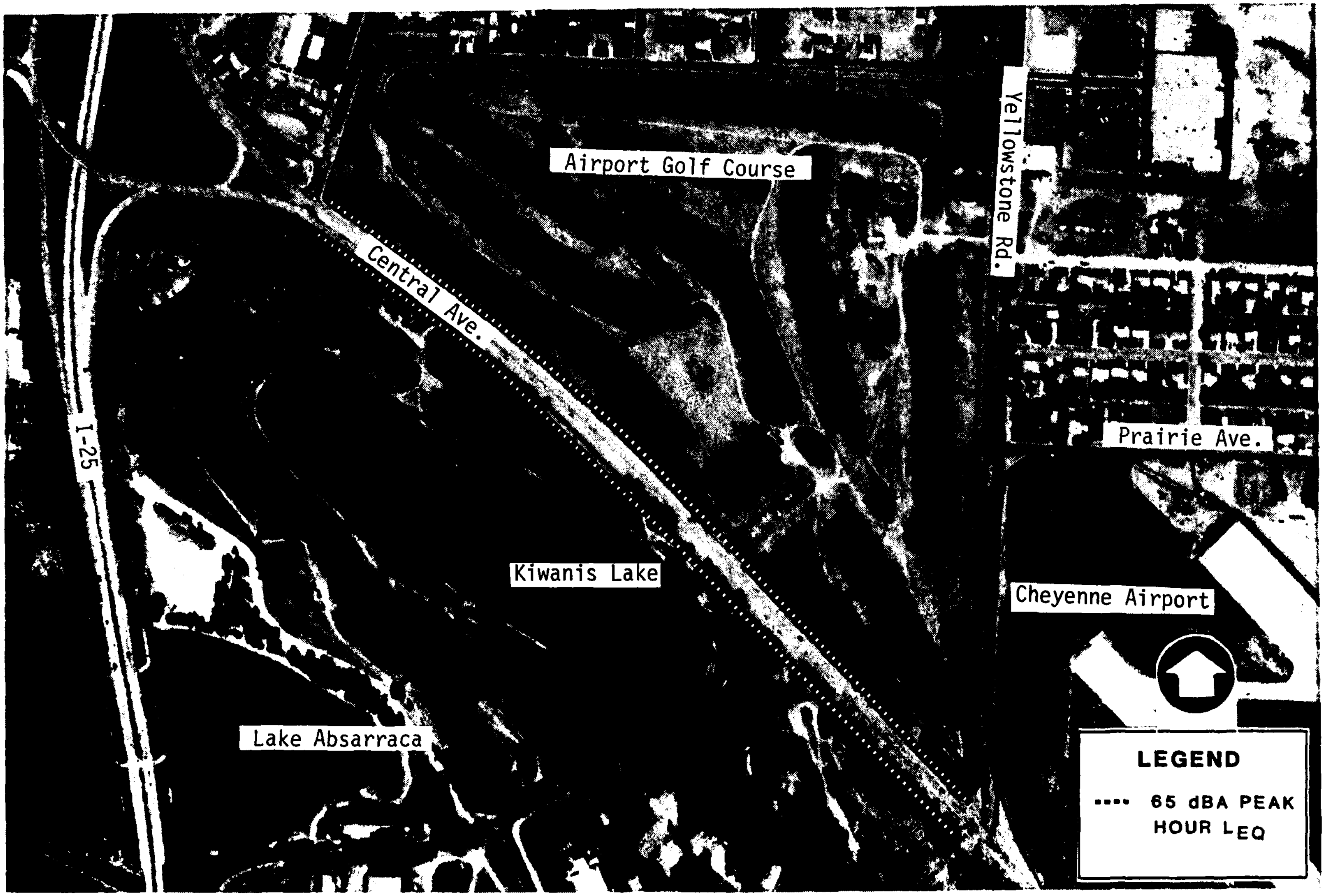


FIGURE C-76 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, I-25 TO YELLOWSTONE ROAD

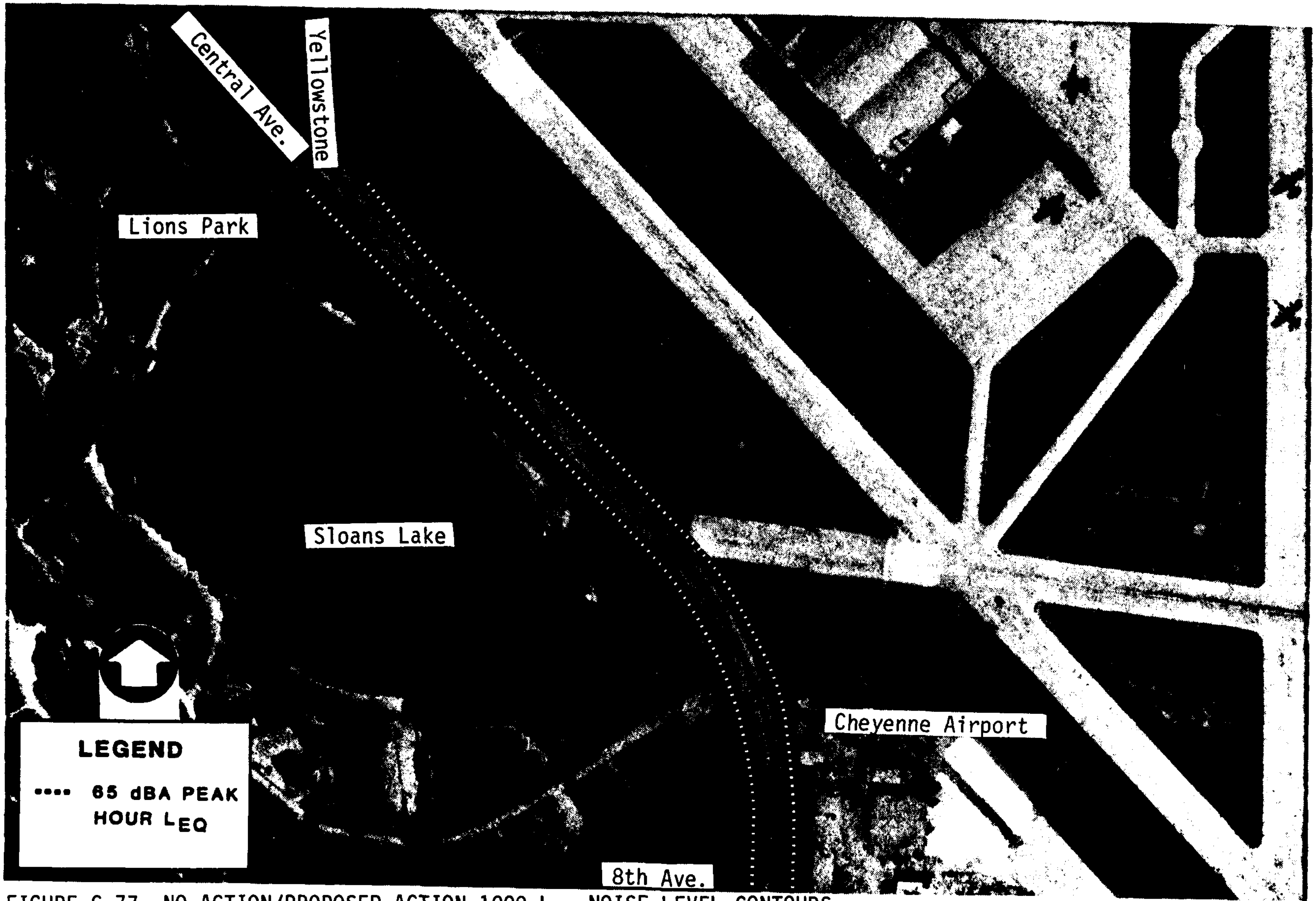


FIGURE C-77 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, CENTRAL AVENUE, YELLOWSTONE ROAD TO EIGHTH AVENUE

FIGURE C-78 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, BENT AVENUE TO EVANS AVENUE

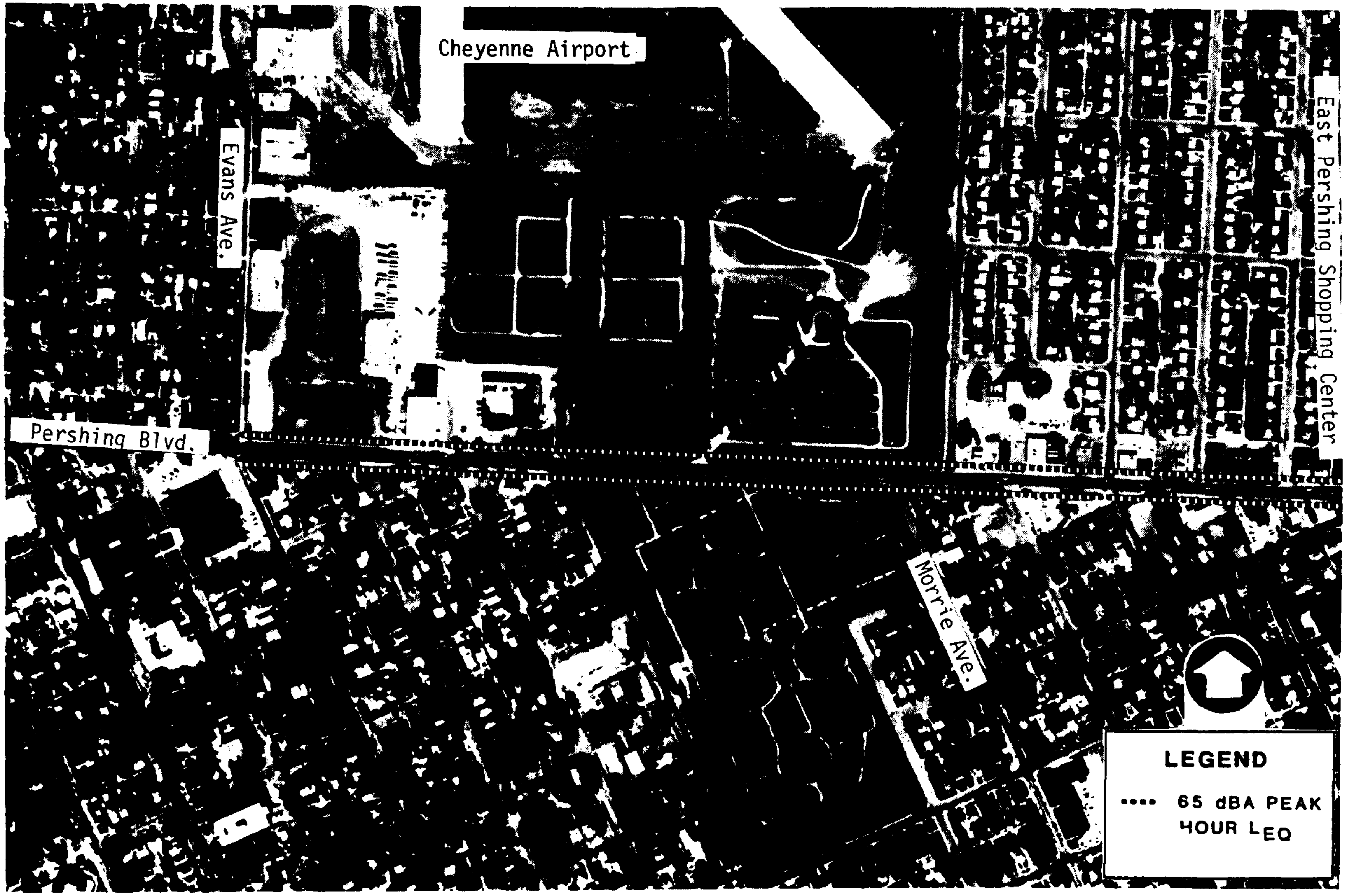


FIGURE C-79 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EVANS AVENUE TO EAST PERSHING SHOPPING CENTER

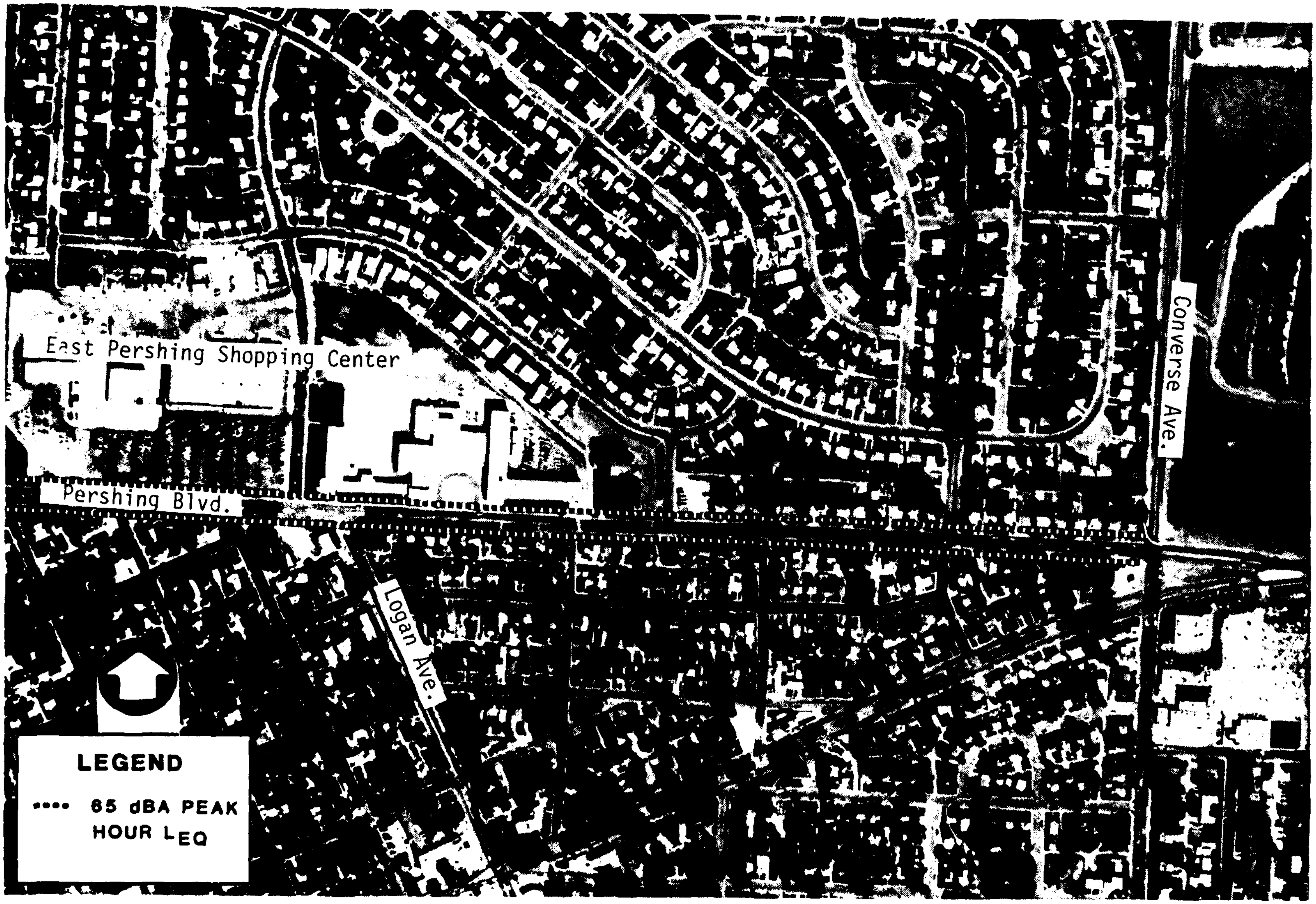


FIGURE C-80 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST PERSHING SHOPPING CENTER TO CONVERSE AVENUE

FIGURE C-81 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, EAST OF CONVERSE AVENUE

FIGURE C-82 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, VICINITY OF WINDMILL ROAD

FIGURE C-83 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, PERSHING BOULEVARD, RIDGE ROAD TO U.S. 30

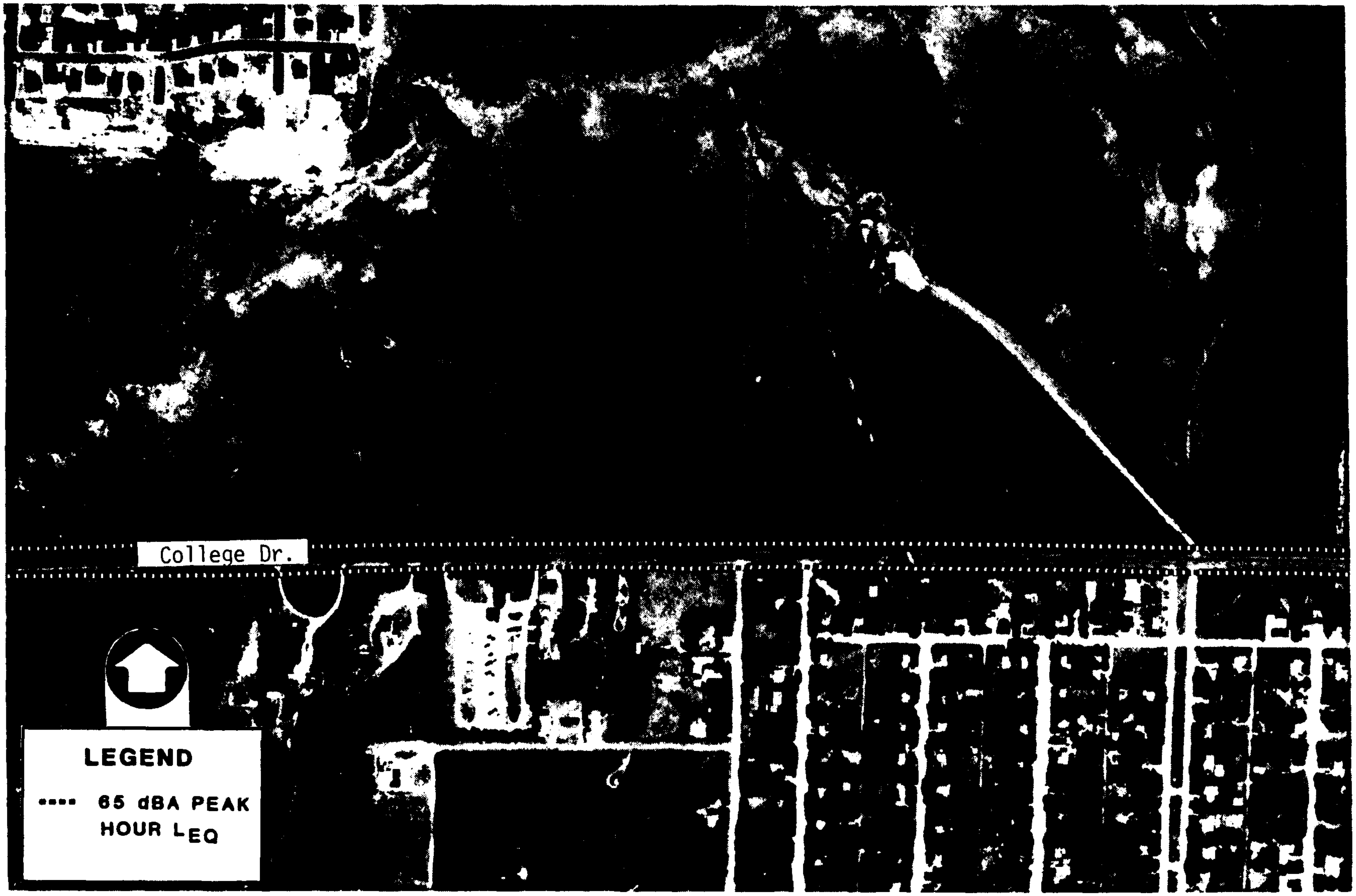


FIGURE C-84 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, COLLEGE DRIVE, BETWEEN PARSLEY BOULEVARD AND WALTERSCHEID BOULEVARD

FIGURE C-85 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR DELL RANGE BOULEVARD

FIGURE C-86 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, WINDMILL ROAD, NEAR PERSHING BOULEVARD

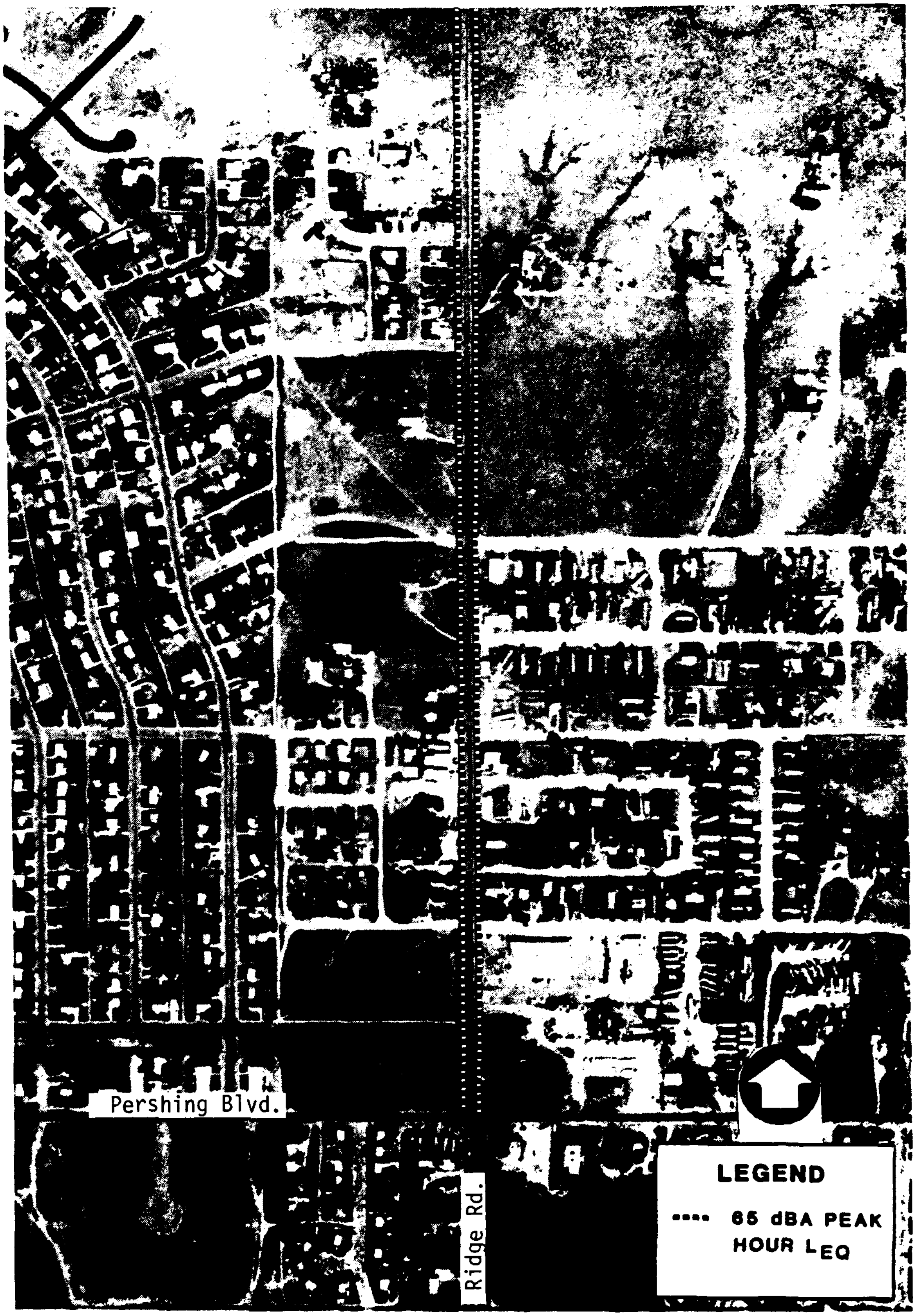


FIGURE C-87 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, NORTH OF DELL RANGE BOULEVARD

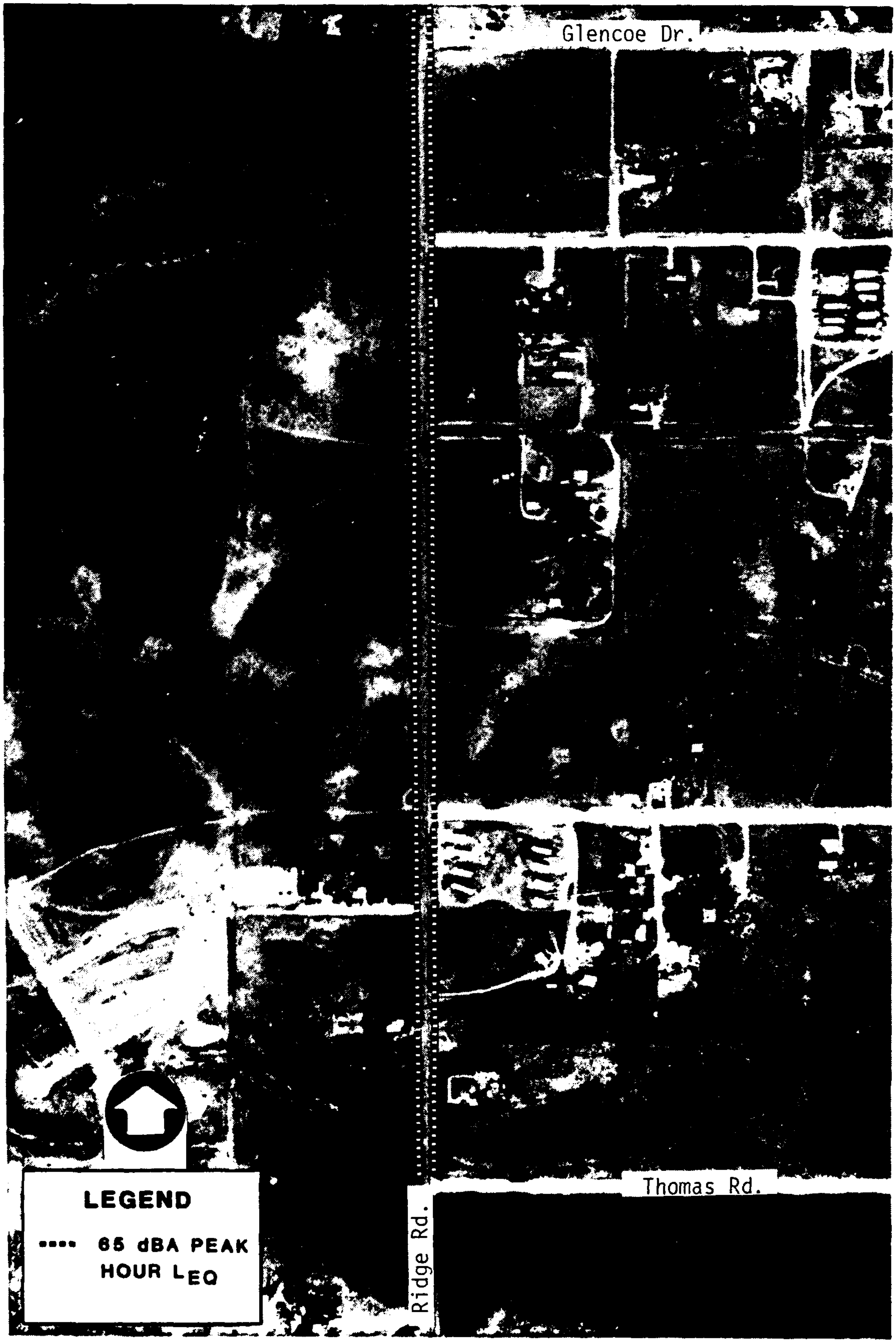


FIGURE C-88 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, THOMAS ROAD TO GLENCOE DRIVE

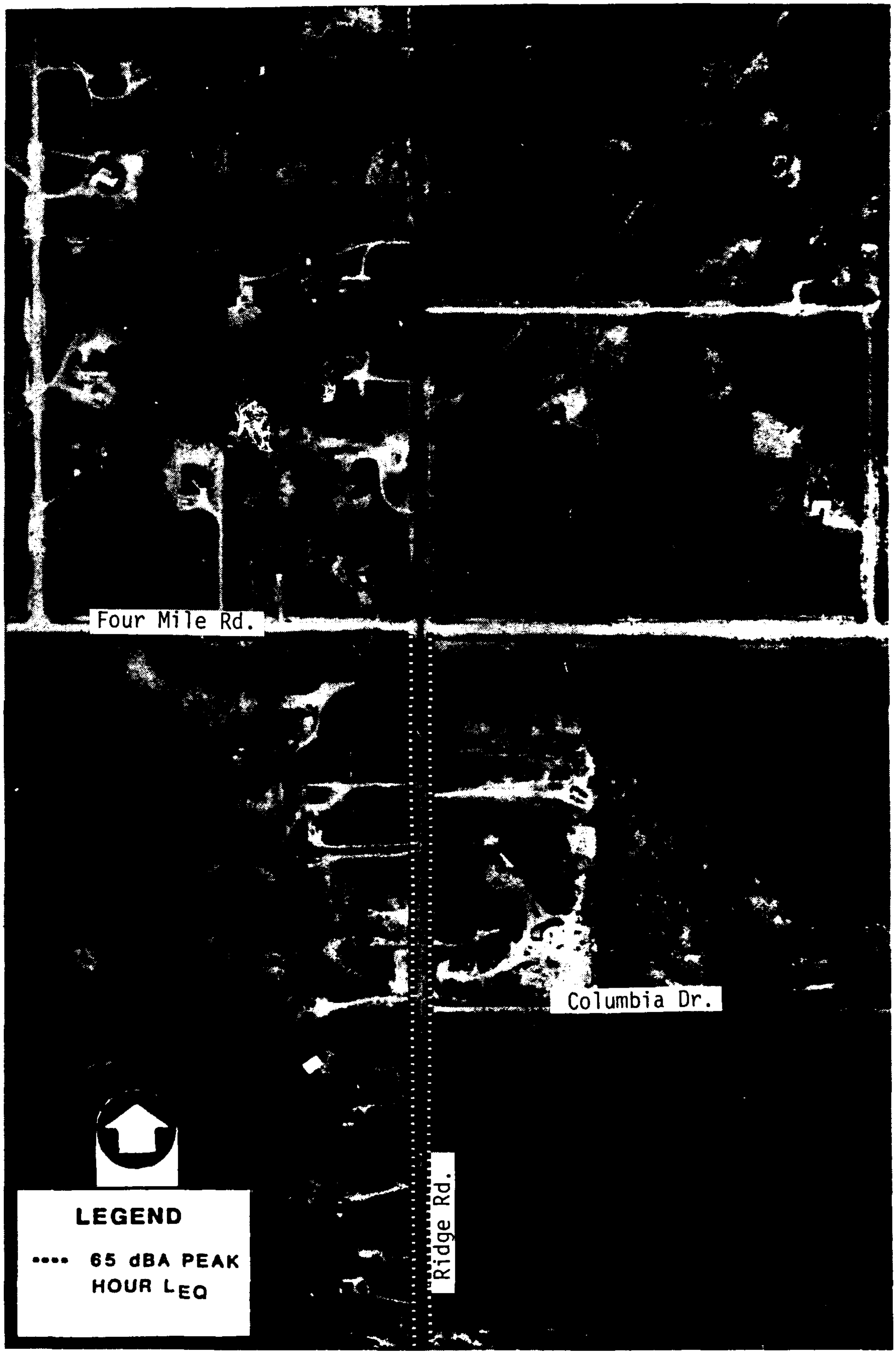


FIGURE C-89 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, RIDGE ROAD, SOUTH OF FOUR MILE ROAD

FIGURE C-90 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, LINCOLNWAY, MORRIE AVENUE TO LOGAN AVENUE

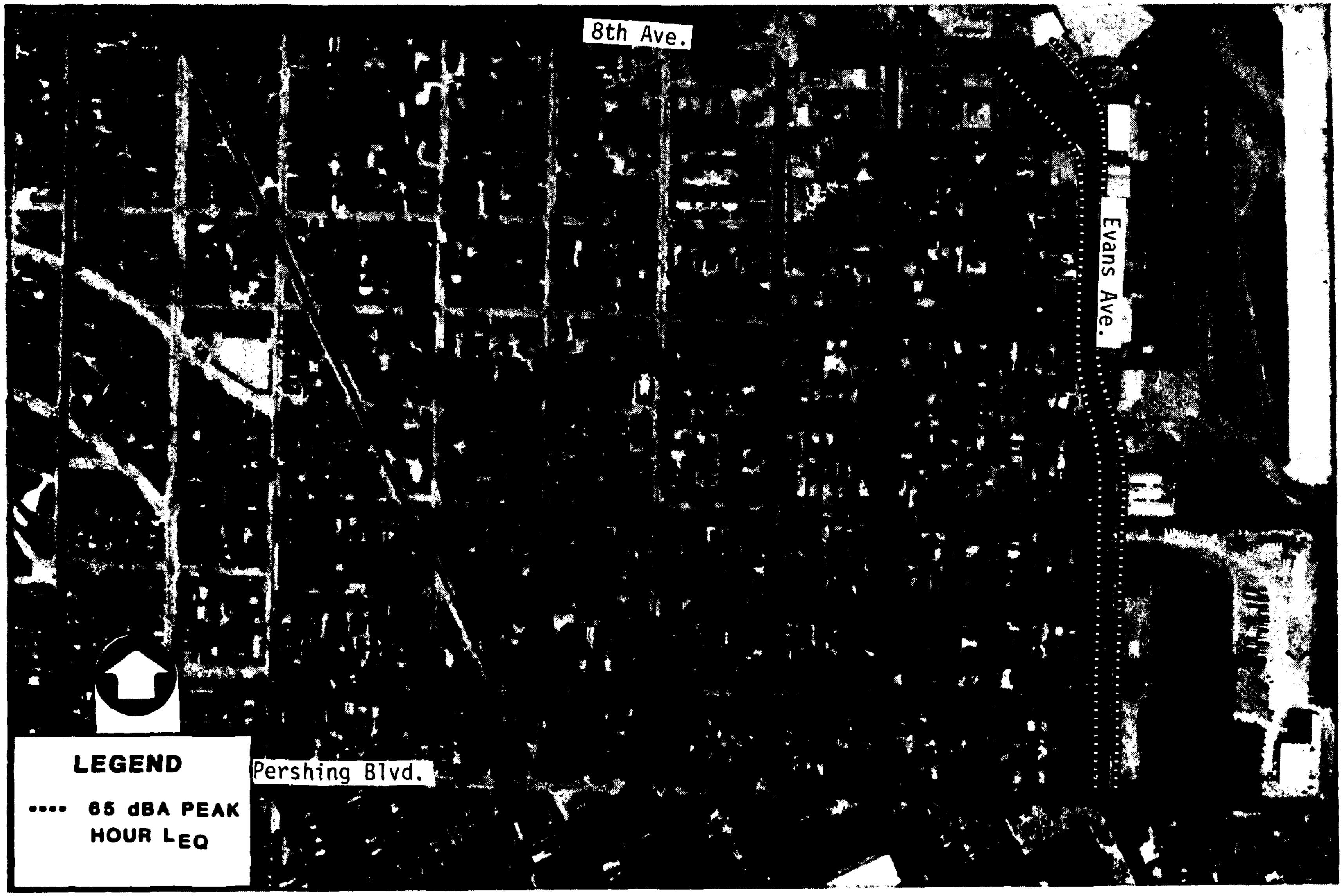


FIGURE C-91 NO ACTION/PROPOSED ACTION 1990 L_{EQ} NOISE LEVEL CONTOURS, EVANS AVENUE, EIGHTH AVENUE TO PERSHING BOULEVARD

APPENDIX D
NOISE ASSUMPTIONS

D.1 STAMINA 2.0 Analysis

The STAMINA 2.0 model was used to predict vehicular noise levels at specified distances from the roadway links. The following assumptions were implicit in the use of this model:

- No buildings, barriers, berms, or trees blocked noise to receptor points. This is a worst-case situation for noise levels at receptor points.

- Ground cover at receptor points was dirt or gravel based on field observations of roadway links. This is also a worst-case condition for receptors located in grassy areas.

- Peak-hour vehicular mix in Cheyenne was the same for all years for the No Action Alternative and was based on peak period field counts.

  - Medium-duty trucks (Interstate 25) - 2.25 percent;
  - Medium-duty trucks (Interstate 80) - 3.75 percent;
  - Medium-duty trucks (all other roadways) - 1.50 percent;
  - Heavy-duty trucks (Interstate 25) - 6.75 percent;
  - Heavy-duty trucks (Interstate 80) - 11.25 percent; and
  - Heavy-duty trucks (all other roadways) - 0.50 percent.

- Peak-hour vehicular volumes were 11 percent of the average daily traffic in Cheyenne.

- Peak-hour vehicular volumes were 11 percent of the average daily traffic in Kimball and Wheatland except for the peak construction year (1986) for the project which were based on specific roadway peak-hour volume increments.

- Peak-hour vehicular speeds equal posted speed limits.

  - Interstate 25 and 80 - 55 mph; and
  - All other roadways were evaluated at 30 to 40 mph depending on posted limits.

- All peak-hour traffic was split 40/60 between northbound and southbound or eastbound and westbound directions.

- No construction-related trucks operated within city boundaries between 10:00 PM and 7:00 AM since construction activities typically take place during normal daytime working hours.

- Constant speed traffic conditions prevailed.

- Peak-hour vehicular mix for U.S. 30 and Route 71 in Kimball and 16th Street and South Street in Wheatland, was the same for all years for the No Action Alternative.

  - Medium-duty trucks - 3 percent; and

  - Heavy-duty trucks - 3 percent.

- Traffic speeds were limited to the range of 30 to 55 mph due to the data limitations upon which vehicle noise emissions are based.

- Relative humidity ranged from 50 to 70 percent.

- Ambient temperature was 68° F.

D.2 FAA Airport Noise Contour Analysis

The Federal Aviation Administration (FAA) procedure was used to determine sets of noise contours surrounding the Cheyenne Airport and was based upon annual air traffic operations. The following assumptions were employed for this procedure:

- Nighttime (10:00 PM to 7:00 AM) flights were negligible based on information provided by the Airport Manager.

- No jets used Runway 16/34 based on information provided by the Airport Manager.

- Twenty-five percent of general aviation operations are business jets based on information provided by the Airport Manager.

- Commercial jet operations would drop dramatically after 1983 based on information provided by the Airport Manager.

- Use of turbojets among business jet operations would continue to decrease in the future based on information concerning existing and projected aircraft sales.

D.3 Railroad Noise Analysis

The Wyle Laboratories procedure was used to predict existing and future train noise levels generated by rail operations at the Cheyenne Railroad Station. The assumptions employed with this procedure were:

- Twenty-five percent of yard operations occurred at night based on information provided by the Station Yardmaster.

- Twenty-five percent of mainline operations occurred at night based on information provided by the Station Yardmaster.

- Maximum noise level reduction due to existing noise barriers was 5 dB based upon barrier height and equations internal to the model.

- Rail cars were 60 feet long. This is a typical car size.
- Yard trains were 50 cars long. This is an average figure used in modeling.
- Mainline trains were 100 cars long. This is a typical figure used in modeling.
- Flat yard standard classification procedures took place based on information provided by the Station Yardmaster.
- No noise barrier (i.e., attenuation) effects were attributed to car storage in the yard which constitutes a worst-case situation.
- Idling classifier diesel and engine testing occurred throughout 24-hour periods.